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AN EVALUATION OF COAL CLEANING PROCESSES AND TECHNIQUES FOR REMOVING PYRITIC SULFUR FROM FINE COAL

Final Report

to Division of Process Control Engineering
Air Pollution Control Office
Environmental Protection Agency

by Bituminous Coal Research, Inc.

for the period January 1970- April 1971

Contract No. CPA 70-26

BCR

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BITUMINOUS COAL RESEARCH, INC.
SPONSORED RESEARCH PROGRAM

AN EVALUATION OF COAL CLEANING PROCESSES AND TECHNIQUES FOR REMOVING PYRITIC SULFUR FROM FINE COAL

Report for the Period January 1970 - April 1971
(BCR Report L-404)
April 1971

I. INTRODUCTION

A. Background

During the combustion of fossil fuels, sulfur oxide compounds are formed and released to the atmosphere. Where it is feasible to physically remove pyrite from coal in significant quantities, the amount of sulfur oxide produced from coal firing can be reduced.

Initial investigations indicated that little information existed on the washability of coals that were mined primarily for use in power generation. To eliminate this deficiency, contracts were awarded to the United States Bureau of Mines, the Illinois Geological Survey, and Commercial Testing and Engineering Company to develop washability data on these seams.

The washability studies were rather unique in that they were to develop information on pyrite liberation at various stages of crushing and grinding rather than developing washability data on the various sized fractions as mined so that the proper sized splits could be made and the proper cleaning equipment and separating gravity selected.

On June 1, 1967, Bituminous Coal Research, Inc., was awarded a contract, No. PH 86-67-139, to develop additional data on selected coals.

The objective of the initial work undertaken by Bituminous Coal Research, Inc., was twofold; first, to extend the washability data to finer sizes of coal, and second, to evaluate coal cleaning methods and techniques for removing pyritic sulfur from the fine-sized coal. From BCR's previous work with pyrite removal from finely sized coal, two size consists were of interest in the washability studies.

The first was the 30 mesh x 0 size as this was the lower limit in sizing that would contain a size range of pyrite typical of a utility pulverizer's recycle load. Recycle load here refers to the pulverizer product which approaches the size capable of escaping the pulverizer classifier. It is this recycle material that can possibly be removed from the utility pulverizer, wet-cleaned to remove the pyrite, and the clean dewatered coal reinjected into the feed to the pulverizer without thermal drying.

The second size range of interest was each coal's "as fired," or pulverized coal (p.c.) grind. It is at this stage of pulverization that maximum pyrite liberation occurs, insofar as the coal's present utilization is concerned. Therefore, it is obvious that the maximum degree of potential pyrite removal has also been reached with each coal's p.c. grind.

The evaluation of coal cleaning methods and techniques was carried out on two size consists, 3/8 inch x 0 and 30 mesh x 0, to optimize pyrite removal using certain selected coals and conventional coal cleaning equipment.

Pyrite concentrations were conducted on the 3/8 inch x 0 refuse after it had been reduced to a topsize of 30 mesh. A portion of this material was further reduced to a 60 mesh topsize and reprocessed. The purpose of these studies was to produce a high-grade pyrite concentrate for possible use as a feedstock to a sulfuric acid plant, or a material which, in combination with high-Btu refuse from either the coal cleaning or pyrite concentration steps, would yield a feedstock for a specially designed, non-polluting, high-sulfur combustor.

By effectively utilizing these high-Btu refuse fractions, the total seam utilization concept, in which maximum use is derived from each coal, will be realized.

The results of the work completed during the calendar year 1969 were reported to the National Air Pollution Control Administration in an interim report dated February 1970, entitled "An Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal," Contract No. PH 86-67-139.

This report is concerned with the results of the work completed under Contract No. CPA 70-26.

B. Objective

The objective of the work undertaken during this time was not significantly different from that for prior work already described in the introduction.

The investigation into the pyrite liberation and removal characteristics of U.S. coals, when pulverized to the two fine grinds of interest, was continued.

Studies were also continued on the concentrating table to further ascertain its potential for removing pyrite from fine-sized coal.

Detailed work was undertaken to determine the potential of fine cleaning for preparing a concentrated grade of pyrite, as removed from the fine coal, in quantities commensurate with the total amount available for removal.

In line with the total seam utilization concept, where only the obvious refuse would be discarded, the use of the intermediate fractions lying between the clean coal and the high grade pyrite was studied.

C. Approach

Twenty-two additional coals were evaluated under Phase I of the program, Pyrite Liberation and Removal Characteristics. These coals were from three geographical areas, the East, the South, and the Midwest. Each coal was pulverized to a topsize of 30 mesh and to its p.c. grind; each grind was subjected to a float-sink separation at a 1.60 specific gravity in the centrifuge; and finally, sulfur reduction calculations were made for both total and pyritic sulfur.

Nine Eastern coals were collected by BCR personnel and subjected to two-stage cleaning studies under Phase II of the program to determine the suitability of the concentrating table for cleaning these coals at a topsize of 30 mesh. Each coal was rough cleaned on the concentrating table at a 3/8 inch topsize to remove the obvious impurities. The coal fraction was then crushed to a topsize of 30 mesh and recleaned using the concentrating table.

In the beneficiation studies, the raw material for testing was obtained by accumulating the heavier gravity refuse during the rough cleaning of the 3/8 inch x 0 coal on the quarter-size (No. 14) concentrating table. This heavy refuse was then pulverized to minus 30 mesh and the pyrite concentration was undertaken using a 15-S metallurgical concentrating table. The 15-S table has approximately one-fourth the surface, or cleaning area, of the quarter-deck coal cleaning concentrating table.

To simulate the recirculation of middling product that had been further reduced in size to increase pyrite liberation, the middling material from the process was collected, pulverized to minus 60 mesh, and recleaned on the same 15-S concentrating table. Although these beneficiation studies were included under Phase IV of the preceding report, they were combined with Phase II studies during this period to establish a Coal Cleaning and Pyrite Beneficiation Phase.

Numerous high-sulfur, high-ash fractions containing significant quantities of combustible material were also collected during the three concentrating table tests and analyzed. Sufficient data were obtained so that an initial evaluation could be made of the potential use of these fractions in a high-sulfur combustor. Tests for calorific value, ash fusion, and ash analysis by spectrography were added to the Phase II program during this period, and reflect the increased importance of determining the combustion and ash characteristics of the high-ash, high-sulfur fractions having potential for use in a high-sulfur combustor.

II. DISCUSSION OF PHASE I EVALUATIONS

A. Test Procedure

The test procedure utilized for the twenty-two coals was identical to the procedure described in the previous interim report, submitted to NAPCA by Bituminous Coal Research, Inc., dated February 1970. This test procedure, in brief, consisted of the pulverization of small representative samples of the ROM coal as received from Commerical Testing and Engineering Company to (1) a topsize of 30 mesh and (2) the coal's p.c. grind. Each sample was then separated into a clean coal fraction and refuse fraction at a 1.60 specific gravity in a centrifuge. Total sulfur and pyritic sulfur analyses of the "as received" ROM coal and the clean coal, or 1.60 float material, of both the 30 mesh x 0 grind and p.c. grind, were utilized to determine the percent sulfur reduction.

B. Summary of Results

The percent sulfur reductions are shown in Tables 1 and 2. Table 1 also shows the percent pyritic sulfur reduction obtained by Commercial Testing and Engineering Company with these coals when they were crushed to topsizes of 3/8 inch and 14 mesh, and cleaned at 1.60 specific gravity. Table 2 shows the same information for total sulfur reduction.

Figure 1, a series of curves, shows the total sulfur reduction at 1.60 specific gravity for the 22 Eastern, Southern, and Midwestern coals as a function of topsize. The range is from Commercial Testing's 1-1/2 inch topsize down to BCR's extremely fine p.c. grind. It can be seen that, at the 1-1/2 inch topsize, about 55 percent of the coals tested (12 coals) could be reduced in total sulfur content by 30.1 to 40 percent when washed at a 1.60 specific gravity. The highest total sulfur reduction obtained was in the 70.1 to 80 percent range, with about 9 percent (two coals) at their p.c. grind. The actual reductions for these coals were 75.8 and 76.5 percent for Lot Nos. 2446 and 2478, respectively. These curves also show that the greatest total sulfur reduction is obtained when the coal is reduced in size from a 30 mesh topsize.

Figure 2 combines this total sulfur reduction data with that obtained on the original 90 coals as reported in the two previous interim reports to NAPCA, dated September 1969, and February 1970. Here the curves show that the greatest total sulfur reduction is obtained when the coal is reduced in size from a 1-1/2 inch topsize. This is shown by the horizontal displacement between the curves. Also, the second greatest reduction is obtained when the coal is reduced from a 30 mesh topsize to the coal's p.c. grind.

The ash reductions obtainable with these coals, when they are cleaned at 1.60 specific gravity, are shown in Table 3. High ash reductions at the largest topsize indicate that this ash equivalent occurred as obvious impurities, such as roof material or seam-included rock layers. Gradual ash reductions certainly reflect the reduction of

TABLE 1. PYRITIC SULFUR REDUCTION AT 1.60 SPECIFIC GRAVITY AS RELATED TO NOMINAL TOPSIZE OF COAL

Coal Lot	Identification Seam	Location County, State	Pyritic Sulfur, Weight Percent, Raw ROM Coal	Reduction at 1.60 Float, Percent			
				CTECO 3/8" X 100M	CTECO 14M X 0	BCR 30M X 0	BCR p.c. Grind
2437	Upper Freeport	Preston, W. Va.	1.93	75.4	83.3	86.0	90.7
2438	No. 6	Tuscarawas, Ohio	3.57	63.6	66.7	61.6	70.0
2439	No. 9	Muhlenburg, Ky.	2.89	52.5	55.2	37.7	49.5
2440	Black Creek	Jefferson, Ala.	0.34	78.6	77.4	76.5	44.1
2441	No. 5	Tuscarawas, Ohio	5.99	59.1	63.1	64.6	73.5
2442	Upper Freeport	Preston, W. Va.	0.82	78.0	85.6	92.7	85.3
2443	Wadge	Routt, Colorado	0.30	44.4	60.0	40.0	20.0
2444	Baxter	Crawford, Kansas	3.33	37.6	53.4	46.2	67.6
2445	No. 9	Ohio, Kentucky	2.77	44.7	50.7	33.9	53.4
2446	No. 3-A	Tuscarawas, Ohio	2.28	80.6	87.0	88.2	89.0
2447	Lower Freeport	Butler, Pa.	1.55	46.8	76.2	76.1	90.3
2448	No. 8	Belmont, Ohio	3.35	32.8	40.2	31.6	45.7
2449	No. 12	Muhlenburg, Ky.	3.16	46.2	50.2	49.1	62.0
2450	Upper Freeport	Preston, W. Va.	1.71	74.1	84.5	84.2	91.8
2476	No. 9	Hopkins, Ky.	2.20	55.5	58.4	30.9	28.6
2477	No. 9	Hopkins, Ky.	2.72	64.3	65.1	46.3	56.2
2478	No. 6	Butler, Ky.	3.85	76.2	82.2	85.5	88.1
2479	Upper Freeport	Preston, W. Va.	1.48	61.2	73.9	77.0	89.9
2480	No. 14	Hopkins, Ky.	2.92	53.5	51.8	49.7	65.1
2481	Fire Clay	Crawford, Kansas	3.28	36.3	41.7	40.2	58.8
2482	No. 6	Hopkins, Ky.	1.53	57.7	57.4	56.2	64.1
2483	No. 9	Davies, Ky.	3.13	66.4	68.7	56.2	59.4

TABLE 2. TOTAL SULFUR REDUCTION AT 1.60 SPECIFIC GRAVITY AS RELATED TO NOMINAL TOPSIZE OF COAL

Coal Identification Lot	Seam	Location County, State	Total Sulfur, Weight Percent, Raw ROM Coal	Reduction at 1.60 Float, Percent CTECO 3/8" X 100M	CTECO 14M X 0	BCR 30M X 0	BCR p.c. Grind
2437	Upper Freeport	Preston, W. Va.	2.47	61.2	67.6	66.8	70.0
2438	No. 6	Tuscarawas, Ohio	4.46	46.5	51.0	52.5	59.2
2439	No. 9	Muhlenburg, Ky.	4.28	28.2	30.2	31.3	41.6
2440	Black Creek	Jefferson, Ala.	0.93	21.1	23.9	24.7	24.7
2441	No. 5	Tuscarawas, Ohio	7.15	42.9	46.3	56.4	64.2
2442	Upper Freeport	Preston, W. Va.	1.38	49.3	55.6	55.1	52.2
2443	Wadge	Routt, Colorado	0.54	7.4	9.4	18.5	7.4
2444	Baxter	Crawford, Kansas	4.43	23.0	35.2	36.6	52.6
2445	No. 9	Ohio, Kentucky	4.00	21.4	25.8	24.7	36.2
2446	No. 3-A	Tuscarawas, Ohio	2.69	65.2	70.9	75.8	75.8
2447	Lower Freeport	Butler, Pa.	2.20	32.9	56.1	58.2	66.8
2448	No. 8	Belmont, Ohio	5.06	17.8	22.5	24.3	33.4
2449	No. 12	Muhlenburg, Ky.	4.08	32.7	36.6	42.4	52.2
2450	Upper Freeport	Preston, W. Va.	2.44	55.8	64.0	65.2	69.7
2476	No. 9	Hopkins, Ky.	3.98	16.7	18.3	17.1	20.6
2477	No. 9	Hopkins, Ky.	3.83	30.2	31.6	33.7	39.2
2478	No. 6	Butler, Ky.	4.48	63.3	71.3	75.0	76.5
2479	Upper Freeport	Preston, W. Va.	2.10	38.9	50.0	49.0	57.6
2480	No. 14	Hopkins, Ky.	3.68	37.4	37.4	42.4	52.2
2481	Fire Clay	Crawford, Kansas	4.18	20.5	26.5	32.1	44.7
2482	No. 6	Hopkins, Ky.	2.28	36.8	37.0	38.6	44.7
2483	No. 9	Davies, Ky.	4.10	39.8	42.2	44.1	46.3

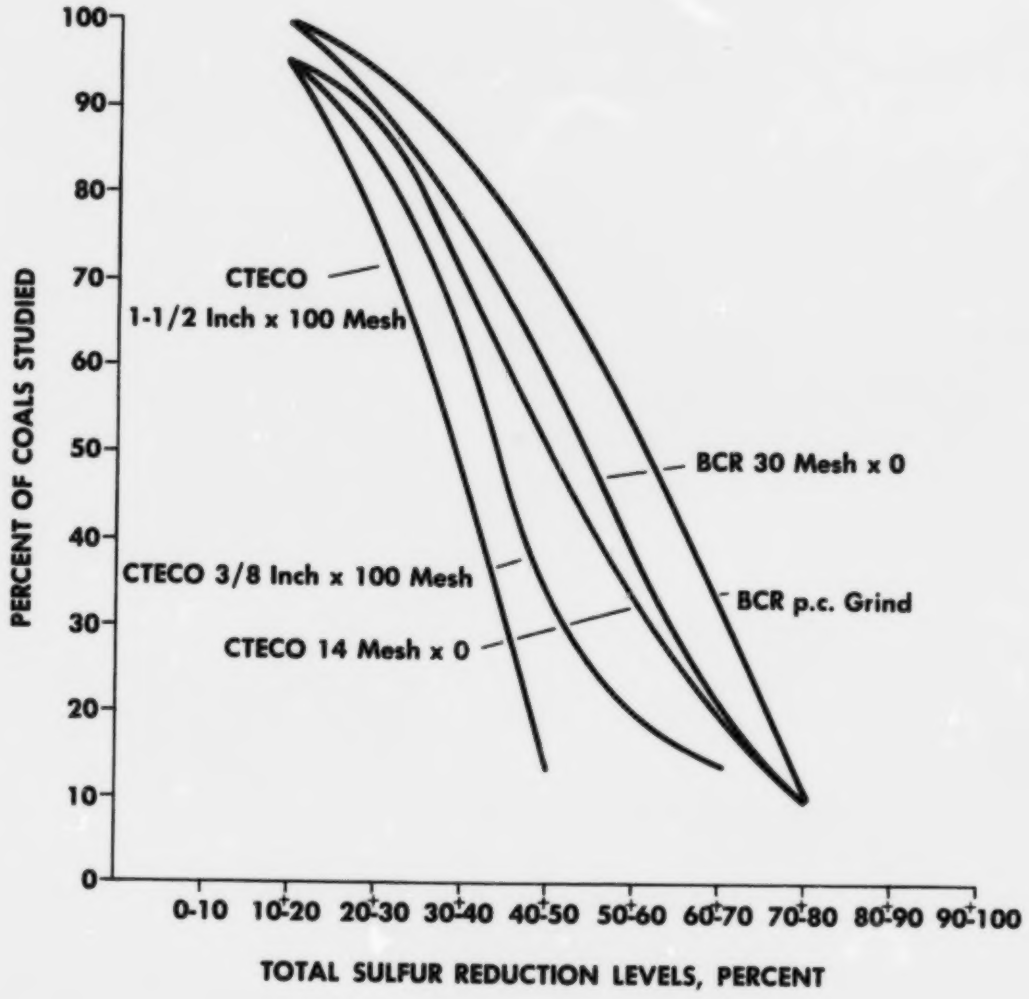

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Figure 1. Total Sulfur Reduction at 1.60 Specific Gravity as Related to Nominal Top Size for Twenty-two United States Coals

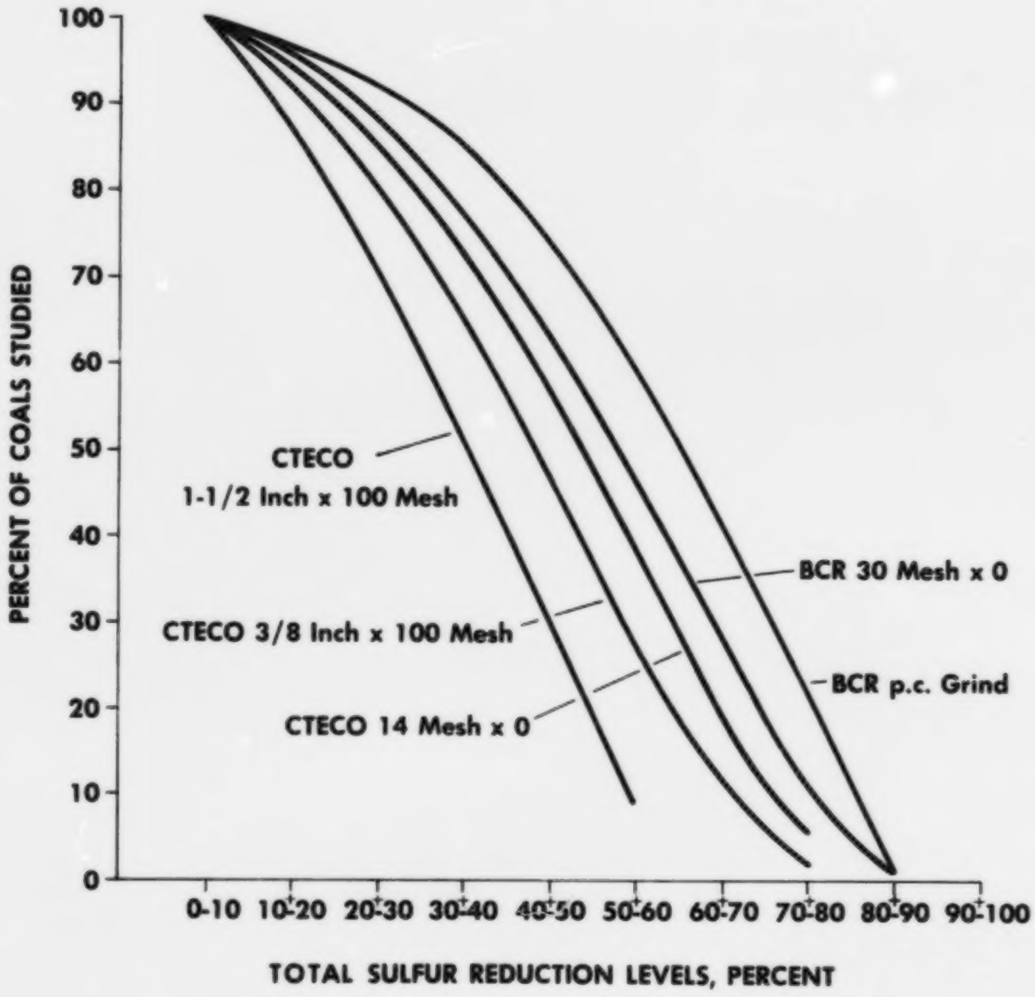

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Figure 2. Total Sulfur Reduction at 1.60 Specific Gravity as Related to Nominal Top Size for One Hundred and Twelve United States Coals

TABLE 3. ASH REDUCTION AT 1.60 SPECIFIC GRAVITY AS RELATED TO NOMINAL TOPSIZE OF COAL

Coal Identification Lot	Coal Identification Seam	Location County, State	Ash, Weight Percent, Raw ROM Coal	Reduction at 1.60 Float, Percent CTECO 3/8" X 100M	CTECO 14M X 0	BCR 30M X 0	BCR p.c. Grind
2437	Upper Freeport	Preston, W. Va.	19.2	63.5	64.5	64.1	67.1
2438	No. 6	Tuscarawas, Ohio	7.76	55.2	57.4	62.2	70.6
2439	No. 9	Muhlenburg, Ky.	9.44	31.4	32.8	37.3	51.5
2440	Black Creek	Jefferson, Ala.	6.71	66.0	67.7	69.3	70.0
2441	No. 5	Tuscarawas, Ohio	12.6	60.0	62.0	70.6	77.5
2442	Upper Freeport	Preston, W. Va.	14.2	55.2	55.6	56.0	62.9
2443	Wadge	Routt, Colorado	9.48	7.9	12.8	16.7	27.5
2444	Baxter	Crawford, Kansas	30.9	59.9	62.4	69.1	72.9
2445	No. 9	Ohio, Kentucky	14.0	48.0	47.0	52.5	59.5
2446	No. 3-A	Tuscarawas, Ohio	7.52	46.2	49.7	51.9	55.9
2447	Lower Freeport	Butler, Pa.	14.0	22.1	33.6	33.8	44.1
2448	No. 8	Belmont, Ohio	12.4	30.0	33.5	36.4	48.1
2449	No. 12	Muhlenburg, Ky.	15.2	38.5	38.9	43.2	50.1
2450	Upper Freeport	Preston, W. Va.	18.2	52.2	54.3	56.0	62.5
2476	No. 9	Hopkins, Ky.	9.48	45.3	44.9	50.2	54.4
2477	No. 9	Hopkins, Ky.	14.9	50.8	50.8	56.4	59.6
2478	No. 6	Butler, Ky.	15.6	72.5	71.5	79.1	76.7
2479	Upper Freeport	Preston, W. Va.	20.8	54.4	56.9	59.0	65.2
2480	No. 14	Hopkins, Ky.	20.4	68.1	62.3	70.7	73.0
2481	Fire Clay	Crawford, Kansas	33.8	65.7	66.2	70.8	69.8
2482	No. 6	Hopkins, Ky.	9.60	65.6	59.2	68.7	70.8
2483	No. 9	Davies, Ky.	15.2	48.9	49.2	59.7	59.8

pyritic sulfur as the topsize of the ROM coal is decreased, but these reductions could also reflect the liberation and removal of other impurities ranging from pure shales to high-ash coal particles.

The individual data sheets for the Phase I test work are contained in the Appendix A to this report, Tables A-1 through A-22.

III. DISCUSSION OF PHASE II EVALUATIONS

A. Test Procedure

1. Coal Cleaning on the No. 14 Concentrating Table: Nine coals were selected for the modified Phase II, Coal Cleaning and Pyrite Beneficiation Tests, a schematic of which is shown in Figure 3. Each coal was rough-cleaned at the 3/8 inch x 0 size consist on the No. 14 concentrating table to effect a separation in which the obvious refuse was removed prior to further size reduction. Figure 4 shows the various zones of material obtained from the concentrating table separation, and the analyses performed on the various fractions.

In the 3/8 inch x 0 rough cleaning, the high carbon refuse fraction, which is normally discharged in actual cleaning plant practice because of its high ash content, was combined with the Zone C material for further processing. It is from this high carbon refuse fraction, together with the high-ash coal normally reporting to Zone C, that significant additional pyrite liberation and removal can be obtained through size reduction and recleaning.

The material obtained from Zones A, B, and C was pulverized to 30 mesh for a second 5-zone separation on the No. 14 concentrating table.

Table 4 shows the size consist of the feed material for both the 3/8 inch x 0 and the 30 mesh x 0 concentrating table tests for a sample coal (BCR Lot No. 2546).

Figure 5 shows the size distribution for the two size fractions discussed for the sample coal. Table 5 shows the ROM chemical analyses of the coals tested under Phase II of the program.

2. Pyrite Beneficiation on the No. 15-S Metallurgical Concentrating Table: The Pyrite Beneficiation work (formerly Phase IV) was started during the period covered by the previous report. BCR purchased a smaller concentrating table, designated as a 15-S, or metallurgical table, having one-fourth of the cleaning area of the quarter deck table (No. 14) being used in the coal cleaning studies and one-sixteenth of the area of a commercial coal cleaning deck.

Figure 6 shows the wide band of pyrite concentrate produced by this table. The sampling mechanism is shown in Figure 7. It should be noted that the smaller table was set up with five sampling zones, paralleling the sampling set-up for the larger coal cleaning table.

A

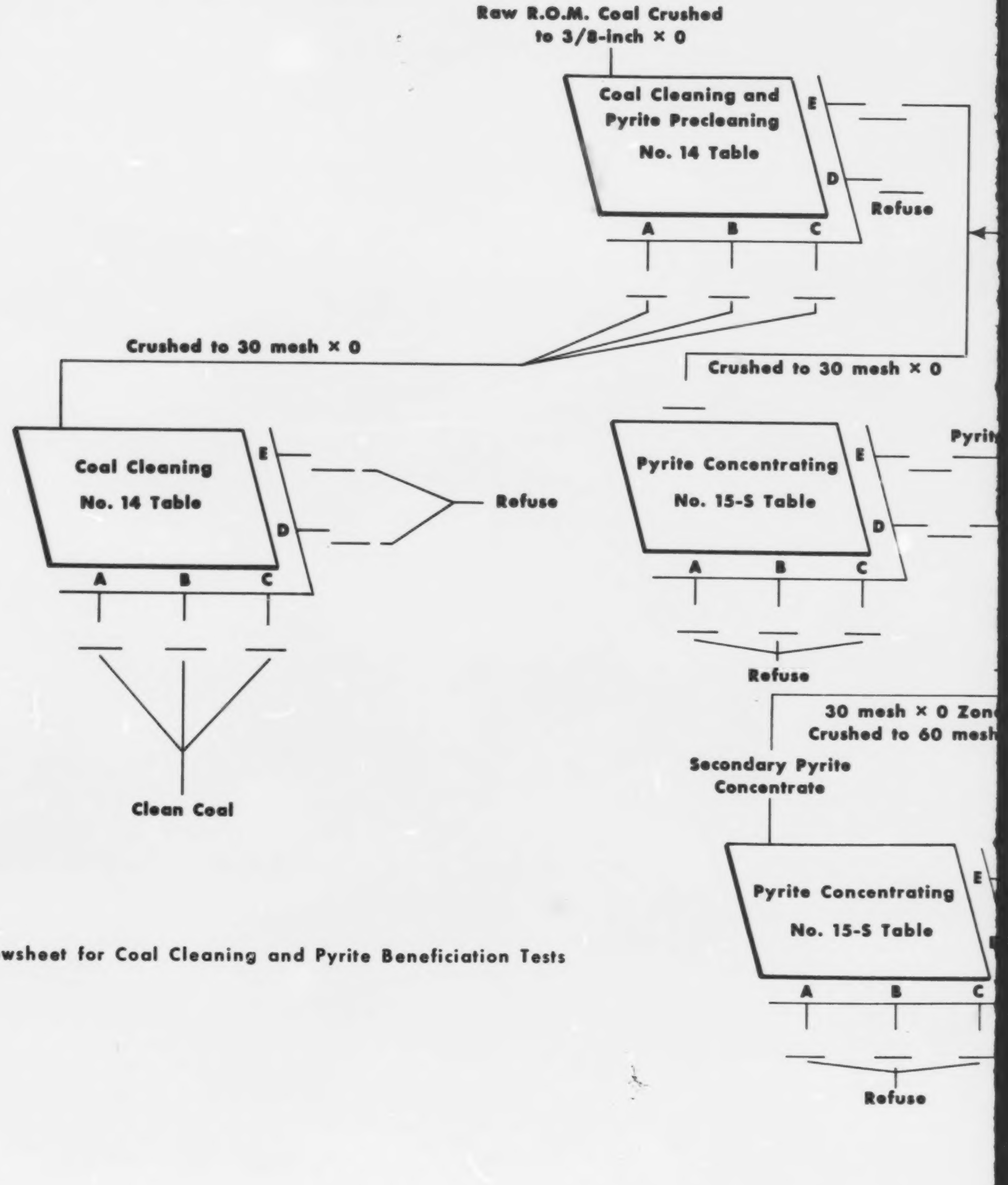
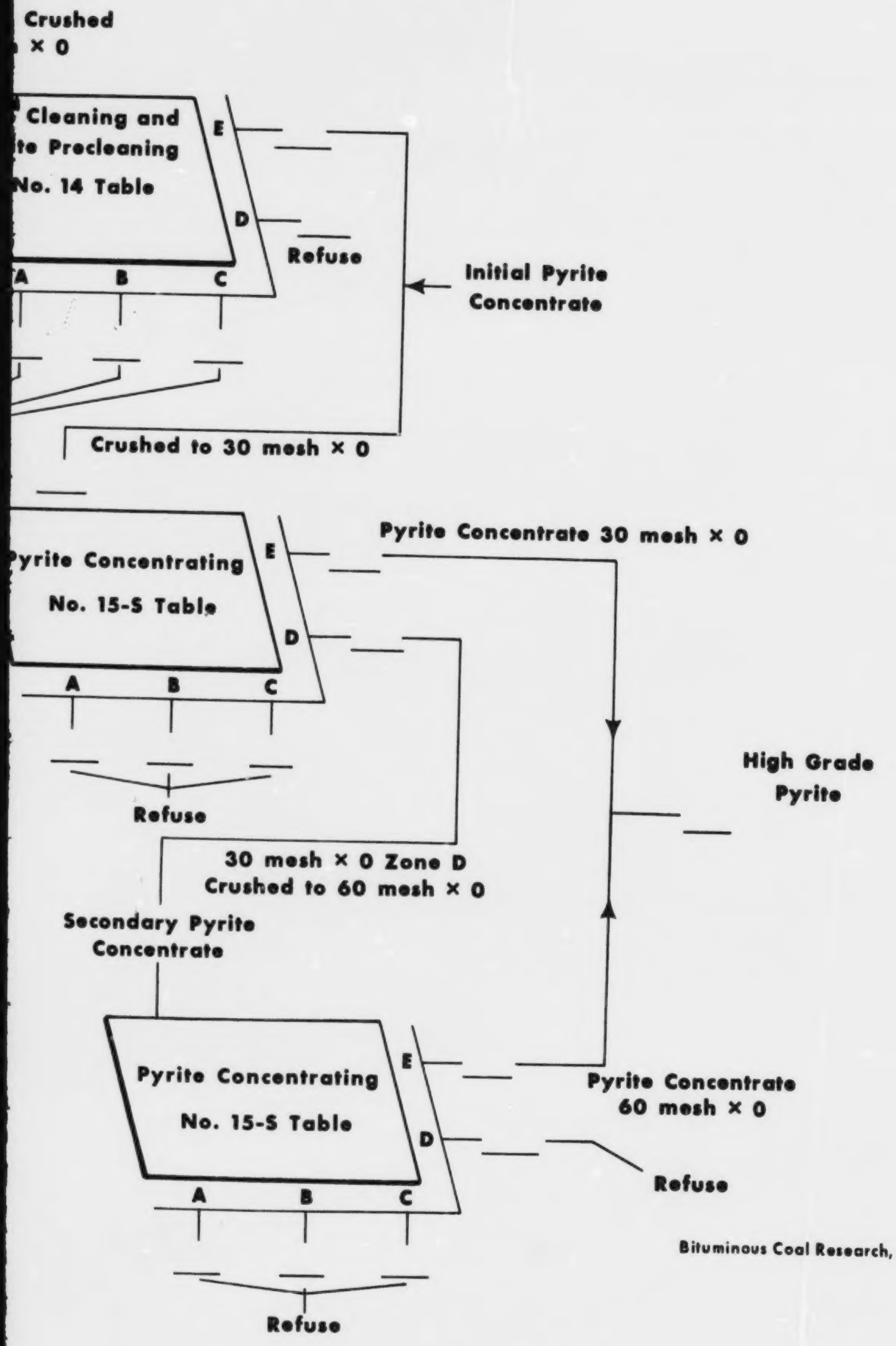

Raw R.O.M. Coal Crushed to 3/8-inch × 0
Coal Cleaning and Pyrite Precleaning No. 14 Table
E
D
A
B
C
Refuse
Crushed to 30 mesh × 0
Crushed to 30 mesh × 0
Coal Cleaning No. 14 Table
E
D
A
B
C
Refuse
Clean Coal
Pyrite Concentrating No. 15-S Table
E
D
A
B
C
Pyrit
Refuse
30 mesh × 0 Zon
Crushed to 60 mesh
Secondary Pyrite Concentrate
Pyrite Concentrating No. 15-S Table
E
A
B
C
Refuse

Figure 3. Flowsheet for Coal Cleaning and Pyrite Beneficiation Tests

β


Crushed
× 0
Cleaning and
te Precleaning
No. 14 Table
E
D
A
B
C
Refuse
Initial Pyrite Concentrate
Crushed to 30 mesh × 0
Pyrite Concentrate 30 mesh × 0
yrite Concentrating
No. 15-S Table
E
D
A
B
C
Refuse
High Grade Pyrite
30 mesh × 0 Zone D
Crushed to 60 mesh × 0
Secondary Pyrite Concentrate
Pyrite Concentrating
No. 15-S Table
E
D
A
B
C
Pyrite Concentrate 60 mesh × 0
Refuse
Refuse

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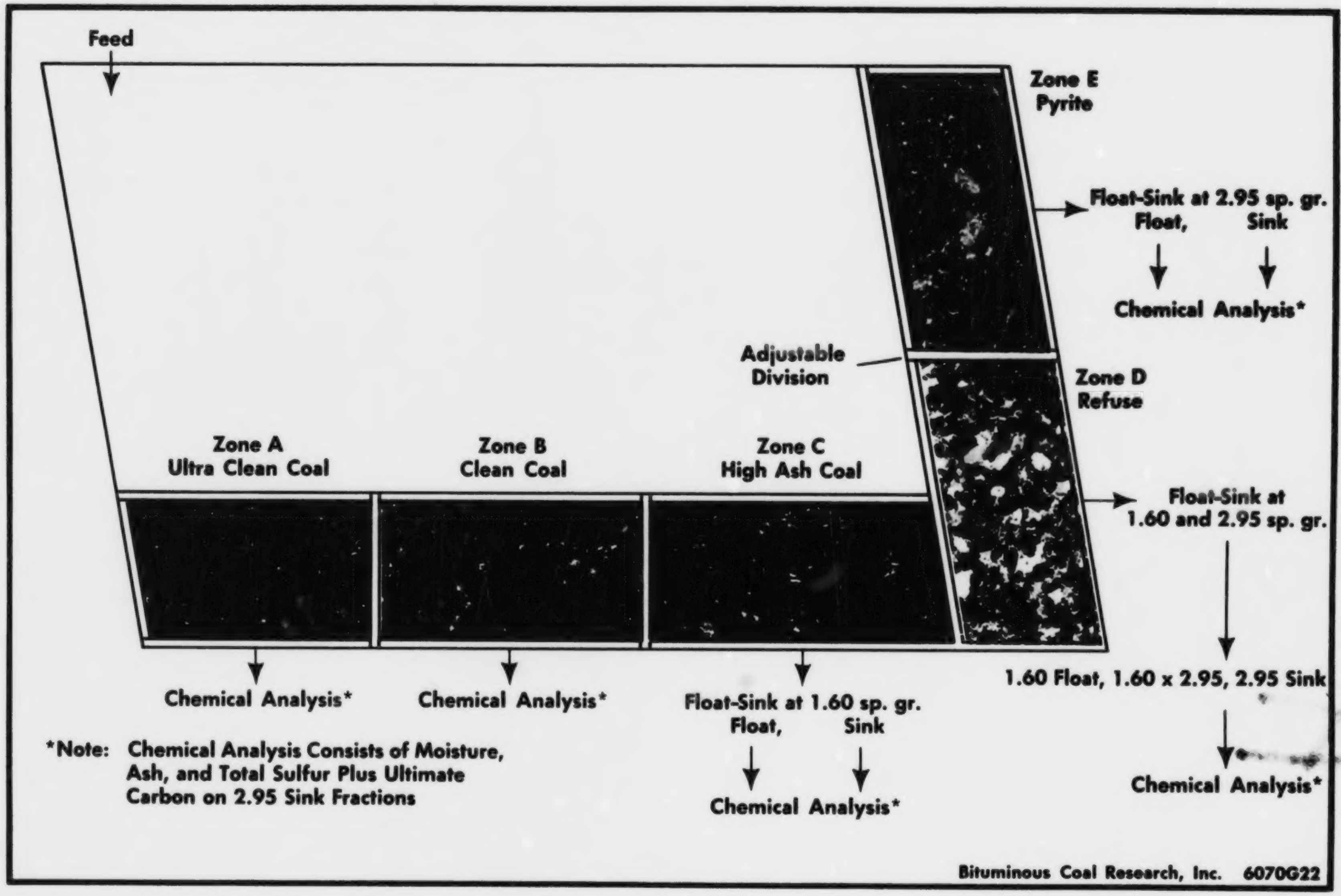
Feed
Zone A
Ultra Clean Coal
Zone B
Clean Coal
Zone C
High Ash Coal
Adjustable
Division
Zone E
Pyrite
Zone D
Refuse
Float-Sink at 2.95 sp. gr.
Float,
Sink
Chemical Analysis*
Float-Sink at
1.60 and 2.95 sp. gr.
1.60 Float, 1.60 x 2.95, 2.95 Sink
Chemical Analysis*
Chemical Analysis*
Chemical Analysis*
Float-Sink at 1.60 sp. gr.
Float,
Sink
Chemical Analysis*

*Note: Chemical Analysis Consists of Moisture, Ash, and Total Sulfur Plus Ultimate Carbon on 2.95 Sink Fractions

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Figure 4. Sampling Flow Sheet for Concentrating Table Tests

TABLE 4. SCREEN ANALYSIS OF A SAMPLE COAL

Coal Identification Upper Freeport Seam, Armstrong County, Pa.

BCR Sample No. 2546

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

Screen Size	Weight Percent	Cumulative
plus 1/4 in.	9.7	9.7
1/4 in. x 6 M	28.1	37.8
6 M x 12 M	22.8	60.6
minus 12 M	39.4	100.0
Total	100.0	

Zones A, B and C from 3/8 Inch x 0 Run (4-9-70) Crushed to 30 Mesh x 0

Screen Size	Weight Percent	Cumulative
plus 30 M	3.7	3.7
30 M x 50 M	32.7	36.4
50 M x 100 M	26.5	62.9
minus 100 M	37.1	100.0
Total	100.0	

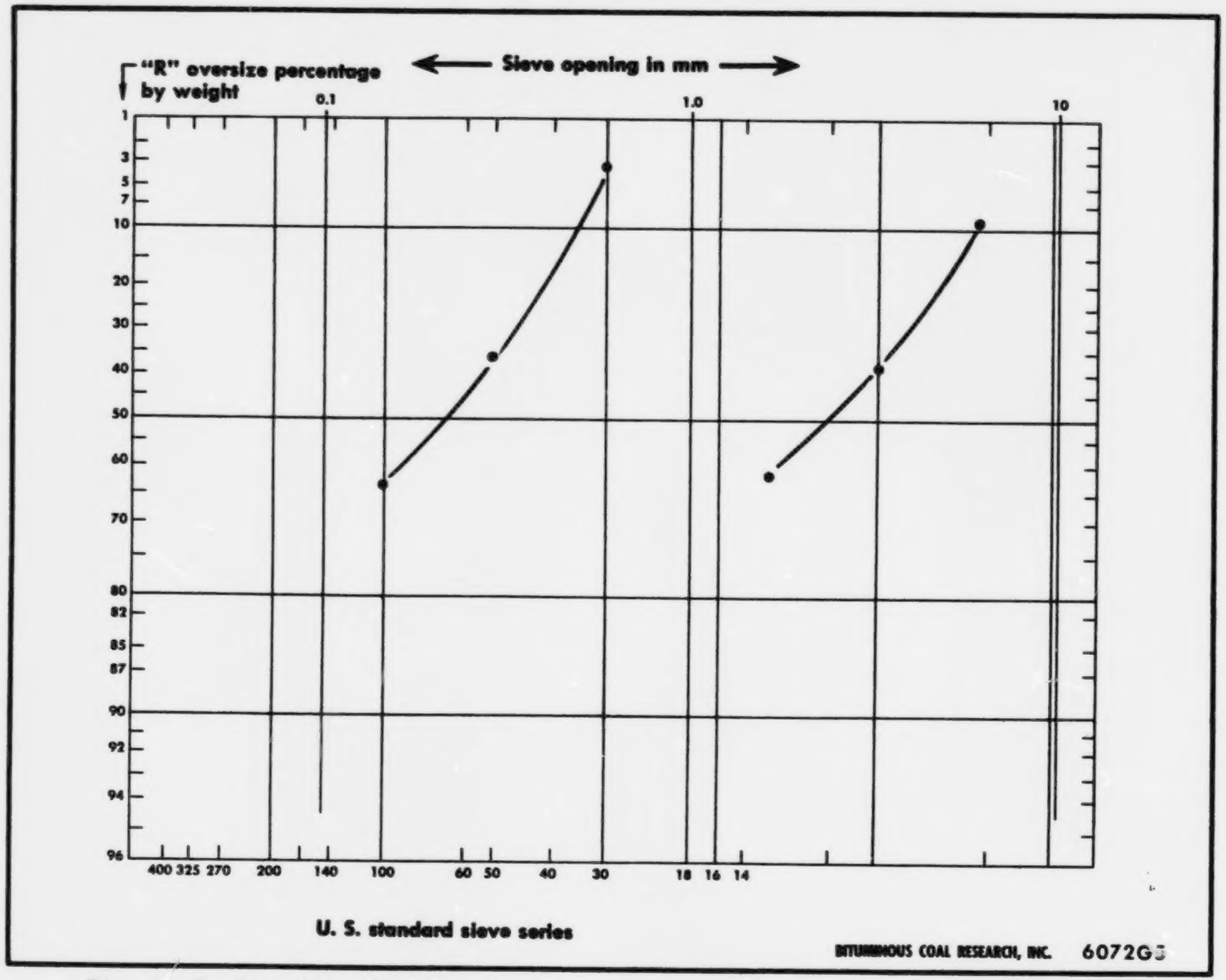

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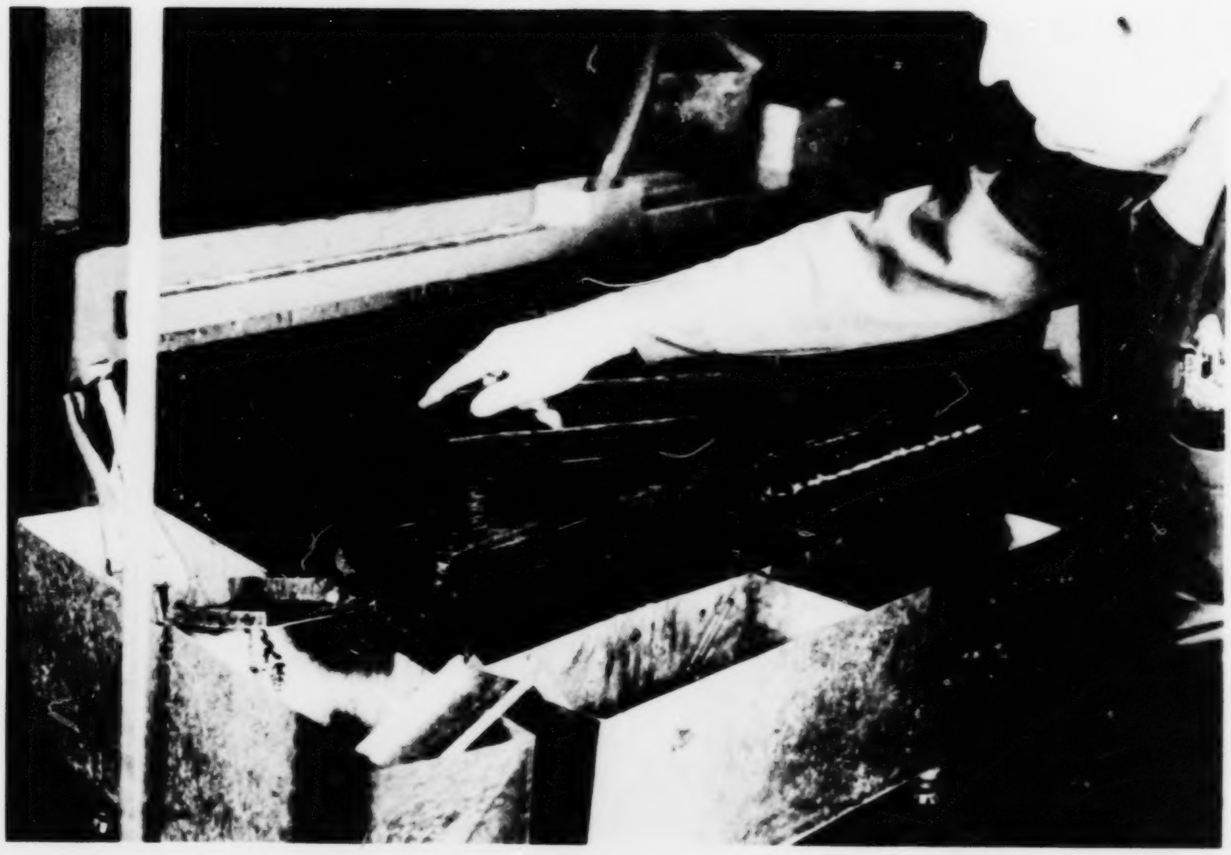
Figure 5. Size Distribution Curves of 30 Mesh X 0 and 3/8 Inch X 0 Concentrating Table Feeds for Upper Freeport Seam, Armstrong County, Pennsylvania, BCR Sample No. 2546

TABLE 5. ANALYSES OF ROM COALS SUBJECTED TO DEEP CLEANING STUDIES, DRY BASIS

Coal Identification		Weight Percent							Calorific
Lot	Seam	Ash	Volatile Matter	Fixed Carbon	Total Sulfur	Sulfate Sulfur	Organic Sulfur	Pyritic Sulfur	Value, Btu/lb
2546	Upper Freeport	18.6	31.2	50.2	2.14	0.04	0.50	1.60	12,368
2555	Pittsburgh	10.5	36.0	53.5	2.52	0.02	1.16	1.34	13,522
2556	Ohio No. 9	15.4	38.2	46.4	3.02	0.06	0.62	2.34	12,238
2574	Ohio No. 8	10.9	39.2	49.9	3.81	0.12	0.76	2.93	12,998
2579	Franklin L.B.	23.6	17.0	59.4	4.28	0.14	0.77	3.37	11,583
2630	Upper Freeport	18.4	28.4	53.2	2.32	0.08	0.47	1.77	12,497
2651	Illinois No. 6	13.4	37.3	49.3	3.45	0.04	0.85	2.56	12,384
2694	Ohio No. 5	14.0	41.2	44.8	6.88	0.24	0.60	6.04	12,146
2713	Upper Freeport	23.1	29.0	47.9	1.86	0.02	0.53	1.31	11,510



6070P60

Figure 6. View of 15-S Concentrating Table Showing Band of High Grade Pyrite Produced

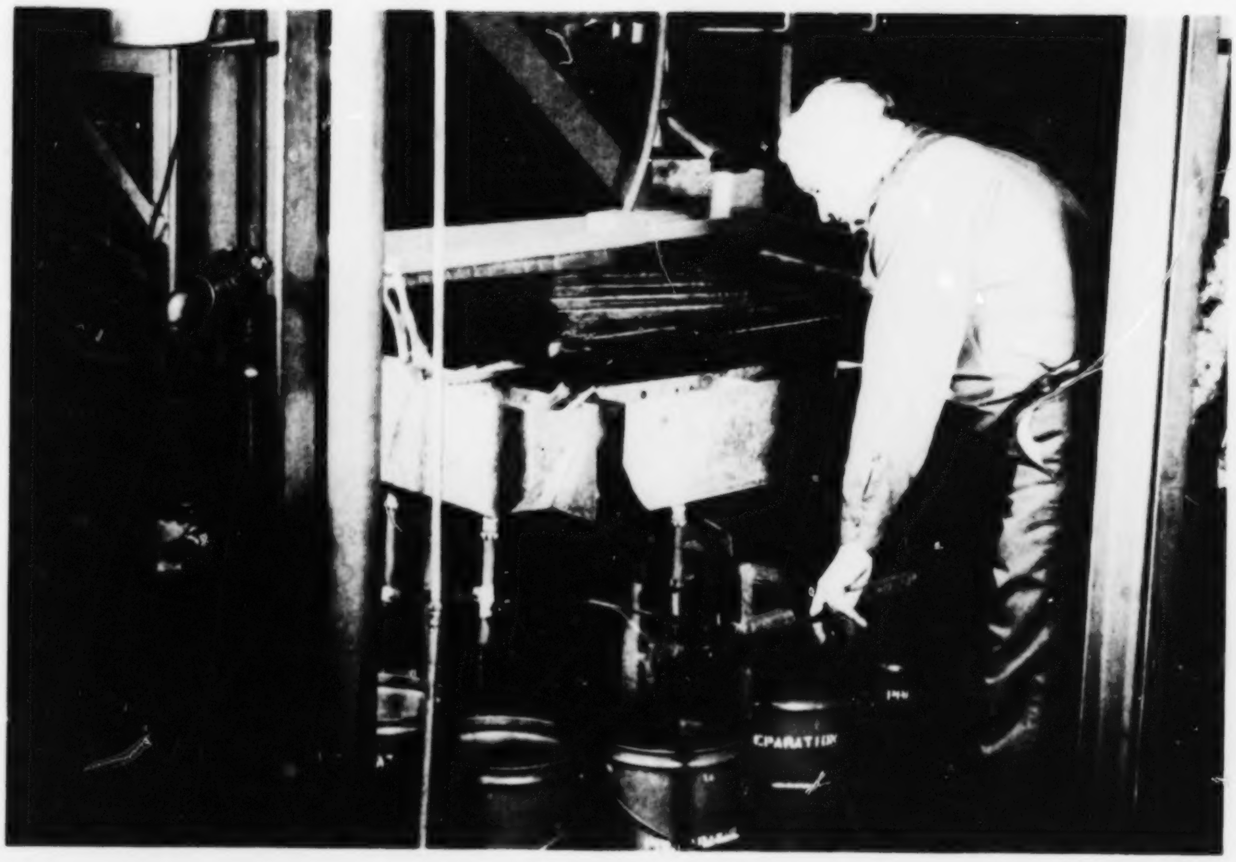


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Figure 7. View of Sampling Device for 15-S Concentrating Table

The feed materials for the pyrite beneficiation studies were obtained by collecting all the normal Zone E material, plus a portion of the material that would have ordinarily gone to adjacent Zone D, during a normal 3/8 inch x 0 cleaning test.

As shown in Figure 4, Zone E is a pyrite-rich fraction from the cleaning test and Zone D is the remaining refuse. The material diverted from Zone D to Zone E is the highest gravity material normally reporting to Zone D and, hence, the material most likely to contain additional pyrite that could be liberated by further size reduction. Nine coals were processed in this manner, and the ash reductions obtained when cleaning these coals at a 3/8 inch x 0 are shown in Table 6.

Table 7 shows the results from a typical 3/8 inch x 0 cleaning test in which a deep cut had been made into the normal Zone D so as to insure that all the pyrite had been captured for subsequent recleaning. This so-called deep cut is evidenced by the higher than normal percentage of 2.95 float material in Zone E.

The modified Zone E material from the coal cleaning test was pulverized to 30 mesh in size for the initial pyrite beneficiation test with the metallurgical table, utilizing the slime deck shown in Figure 3. Table 8 shows a sample copy of the information obtained on the 30 mesh x 0 pyrite cleaning test. The pyrite concentrate from Zone E in this 30 mesh x 0 test, which was very high in total sulfur and low in carbon, was not further processed. The Zone D material from this test was collected, pulverized to minus 60 mesh to further liberate high grade pyrite, and recleaned on the metallurgical table for eight of the nine coals. The 30 mesh x 0 metallurgical table test failed to increase the pyrite concentration for the Ohio No. 5 seam coal and thus the 60 mesh x 0 test was deleted.

Table 9 is a sample copy of the data sheet utilized to show the separation obtained on the metallurgical table when using 60 mesh x 0 feed material. The material breakdown by zones is shown with the secondary pyrite concentrate being obtained from Zone E.

Table 10 is a tabulation of the pyrite cleaning steps, showing, in the last line of figures, that 0.28 percent of the total feed is recoverable as high grade pyrite containing 47.4 percent sulfur.

The sample flowsheet, Figure 8, shows the steps of pyrite cleaning in a different manner, utilizing a schematic flow diagram and showing the distribution of total sulfur in pounds per ton of ROM coal.

The final sample copy of a data sheet (Table 11) shows the chemical data by steps and the total quantity of material removed from each step for subsequent reprocessing.

TABLE 6. ASH REDUCTION OBTAINED BY CONCENTRATING TABLE CLEANING OF 3/8 INCH x 0 ROM COAL

Coal Identification		Ash in ROM Coal, Percent	Clean Coal, Weight Percent	Ash in Clean Coal, Percent	Reduction, Percent
Lot	Seam				
2546	Upper Freeport	18.6	85.6	10.0	46.2
2555	Pittsburgh	10.5	94.8	7.32	30.3
2556	Ohio No. 9	15.4	91.2	12.9	16.2
2574	Ohio No. 8	10.9	93.1	7.66	29.7
2579	Franklin L. B.	23.6	89.1	19.4	17.8
2630	Upper Freeport	18.4	83.9	10.5	42.9
2651	Illinois No. 6	13.4	93.0	9.38	30.0
2694	Ohio No. 5	14.0	93.1	9.98	28.7
2713	Upper Freeport	23.1	85.7	14.8	35.9

TABLE 7. RESULTS FROM A TYPICAL 3/8 INCH x 0 ROUGH CLEANING AND PYRITE PRECLEANING TEST ON THE NO. 14 CONCENTRATING TABLE

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--3/8 Inch x 0 Rough Cleaning

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

Raw Run-of-mine Coal Crushed to 3/8 Inch x 0

BCR Sample No. 2546

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	38.6		0.80	5.99	0.92	
Zone B	33.3		0.64	6.53	1.06	
Zone C						
Float at 1.60	7.4	54.3	0.68	13.1	2.30	
1.60 by 1.90	4.1	29.7	0.84	41.2	4.56	44.6
Sink at 1.90	2.2	16.0	0.76	66.3	5.04	23.5
Composite	13.7	100.0		30.0	3.41	
Zone D						
Float at 1.90	1.0	8.3	0.72	36.9	4.98	44.7
1.90 by 2.95	10.4	88.0	0.77	81.8	3.64	9.2
Sink at 2.95	0.4	3.7	0.41	60.0	38.9	----*
Composite	11.8	100.0		77.3	5.06	
Zone E						
Float at 2.95	1.5	58.5	0.64	82.6	5.54	
Sink at 2.95	1.1	41.5	0.30	62.1	41.7	
Composite	2.6	100.0		74.1	20.5	
Composite of Zones A, B, C	85.6			10.0	1.37	
Composite of 1.60 Float Fractions	79.3			6.88	1.11	
Composite of 2.95 Sink Fractions	1.5			61.5	41.0	
Composite of Table Products	100.0			19.6	2.31	
Analysis of Feed to Table			1.50	18.6	2.14	

Run Date: 4-9-70

* Analysis omitted, insufficient sample

TABLE 8. RESULTS FROM A TYPICAL 30 MESH x 0 PYRITE CLEANING TEST ON THE NO. 15-S CONCENTRATING TABLE

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

Zone E, 3/8 Inch x 0 Run (4-9-70) Crushed to 30 Mesh x 0

BCR Sample No. 2546

Table Products	Product, Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
		Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	9.9	0.24	68.8	13.0	
Zone B	19.5	0.32	76.8	6.90	
Zone C	44.2	0.12	81.5	11.4	
Zone D	15.8	0.11	65.7	41.3	5.9
Zone E	10.6	0.10	64.6	47.4	3.9
Composite of Table Products	100.0		75.04	19.22	
Analysis of Feed to Table			75.2	19.2	

Run Date: 4-24-70

TABLE 9. RESULTS FROM A TYPICAL 60 MESH x 0 PYRITE CLEANING TEST ON THE NO. 15-S CONCENTRATING TABLE

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

Zone D, 30 Mesh x 0 Run (4-24-70) Crushed to 60 Mesh x 0

BCR Sample No. 2546

Table Products	Product, Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
		Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	14.5	0.16	65.8	39.6	
Zone B	33.7	0.16	65.6	39.4	
Zone C	47.8	0.18	65.8	40.2	
Zone D	1.7	0.18	66.5	43.2	3.8
Zone E	2.3	0.14	66.2	48.0	2.2
Composite of Table Products	100.0		65.8	40.1	
Analysis of Feed to Table			65.7	41.3	

Run Date: 4-28-70

TABLE 10. COMPILATION OF RESULTS FROM A TYPICAL PYRITE BENEFICIATION TEST

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

BCR Sample No. 2546

Pyrite Precleaning

Concentrating Table No. 14 Test Run Date 4-9-70

Feed to Concentrating Table: Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	18.6	2.14
Zone E (Pyrite Zone)	2.6	74.1	20.5

Pyrite Cleaning

Concentrating Table No. 15-S Test Run Date 4-24-70

Feed to Concentrating Table: Zone E, 3/8 Inch x 0 Run (4-9-70) Crushed to 30 Mesh x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	75.2	19.2
Zone E (Pyrite Zone)	10.6	64.6	47.4

Concentrating Table No. 15-S Test Run Date 4-28-70

Feed to Concentrating Table: Zone D, 30 Mesh x 0 Run (4-24-70) Crushed to 60 Mesh x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	65.7	41.3
Zone E (Pyrite Zone)	2.3	66.2	48.0

Two Stage Pyrite Product	0.28	64.7	47.4

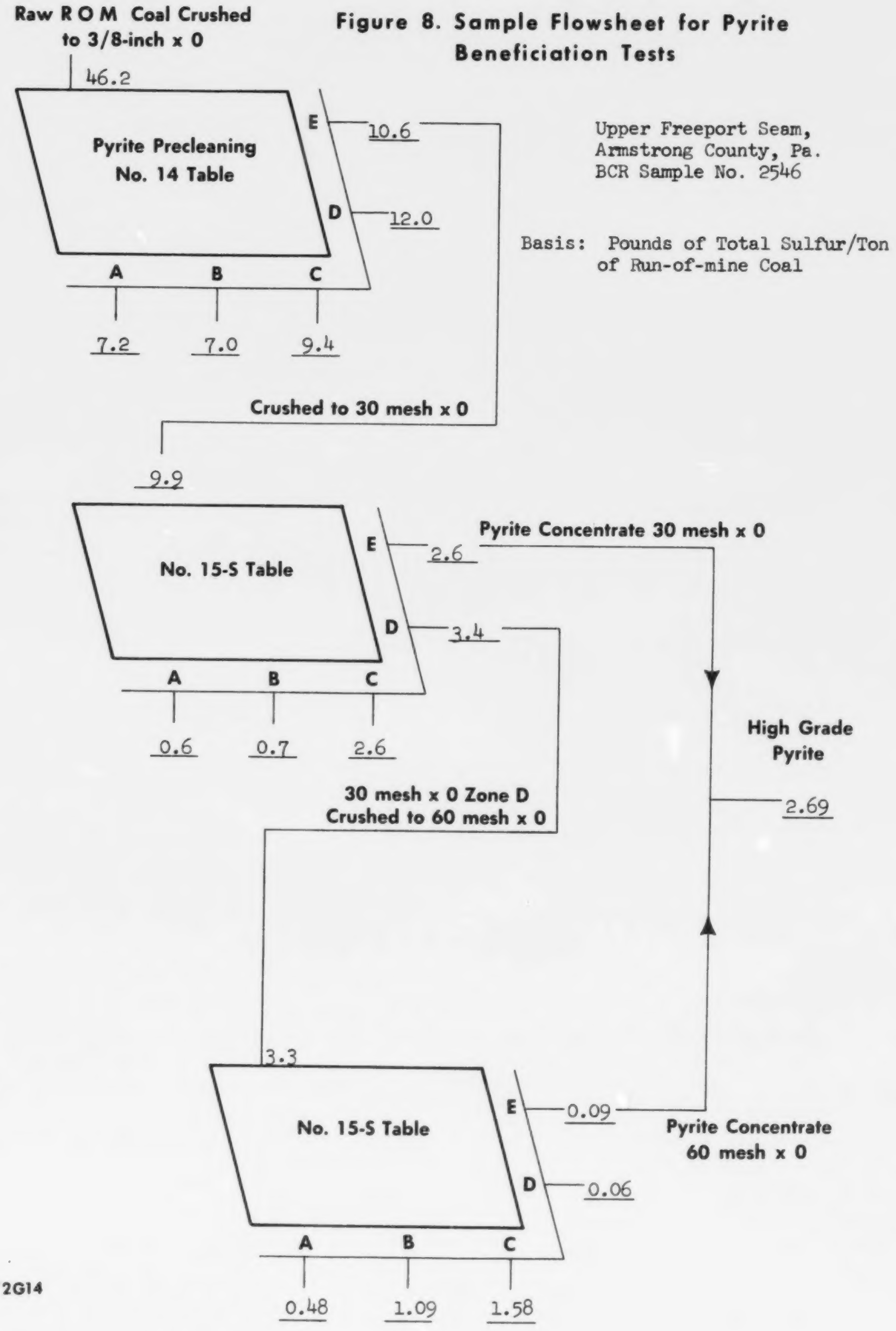

Figure 8. Sample Flowsheet for Pyrite Beneficiation Tests

Upper Freeport Seam,
Armstrong County, Pa.
BCR Sample No. 2546

Basis: Pounds of Total Sulfur/Ton of Run-of-mine Coal

Raw R O M Coal Crushed to 3/8-inch x 0
46.2
Pyrite Precleaning No. 14 Table
E
10.6
D
12.0
A
B
C
7.2
7.0
9.4
Crushed to 30 mesh x 0
9.9
No. 15-S Table
E
2.6
Pyrite Concentrate 30 mesh x 0
D
3.4
A
B
C
0.6
0.7
2.6
High Grade Pyrite
2.69
30 mesh x 0 Zone D Crushed to 60 mesh x 0
3.3
No. 15-S Table
E
0.09
Pyrite Concentrate 60 mesh x 0
D
0.06
A
B
C
0.48
1.09
1.58
6072G14

TABLE 11. SAMPLE FLOWSHEET DATA FOR PYRITE BENEFICIATION TESTS

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

BCR Sample No. 2546

			Chemical Analysis, Dry Basis Weight Percent	
Fraction	**Weight Percent**		**Ash**	**Total Sulfur**
Table No. 14				
Zone A	38.6		5.99	0.92
Zone B	33.3		6.53	1.06
Zone C	13.7		30.0	3.41
Zone D	11.8		77.3	5.06
Zone E		2.6	74.1	20.5
Table No. 15-S (30 Mesh x 0)				
Zone A	0.26		68.8	13.0
Zone B	0.51		76.8	6.90
Zone C	1.15		81.5	11.4
Zone D		0.41	65.7	41.3
Zone E	0.27		64.6	47.4
Table No. 15-S (60 Mesh x 0)				
Zone A	0.06		65.8	39.6
Zone B	0.14		65.6	39.4
Zone C	0.19		65.8	40.2
Zone D	0.01		66.5	43.2
Zone E	0.01		66.2	48.0
Composite of Fractions	100.0		19.7	2.26
Analysis of Feed Coal			18.6	2.14

B. Summary of Results

From the analyses obtained, the Ohio No. 5 seam coal contained the highest percentages of both total and pyritic sulfur. However, the most significant sulfur reduction occurred when the Upper Freeport seam coal from West Virginia was rough cleaned at the 3/8 inch x 0 size and the total sulfur content was reduced from 2.32 percent to 1.32 percent. When the clean coal fraction was pulverized to 30 mesh x 0 and recleaned, the total sulfur content was reduced from 1.32 percent to 1.02 percent.

The Ohio No. 5 seam behaved in a similar manner. The total sulfur content was reduced from 6.88 percent to 4.41 percent when the coal was rough-cleaned at 3/8 inch x 0. Pulverizing the clean coal fraction to 30 mesh and recleaning reduced the total sulfur content from 4.41 percent to 3.30 percent.

Table 12 shows the results obtained to date from the nine Phase II coals tested in preparing a high-grade pyrite concentrate. Column 1 shows the total amount of sulfur available in the ROM coal for removal, and Column 2 shows the percent of pyritic sulfur. Columns 3 and 4 show the percentage of sulfur recovered in the pyrite concentrate; the first for total sulfur and the second for pyritic sulfur. Using the Pittsburgh seam coal as an example, the data show that 3.6 percent of the total sulfur available in the ROM coal ended up in the pyrite concentrate, and this represented 6.7 percent of the pyritic sulfur in the ROM coal. The last column shows the percentage of sulfur in the high grade pyrite.

The complete coal cleaning and pyrite beneficiation data for the nine Phase II coals are shown in Appendix B, Tables B-1 through B-95, and Figures B-1 through B-9.

The pyrite beneficiation data for the Ohio No. 5 seam coal are shown for two size consists: the raw run-of-mine coal crushed to 3/8 inch x 0 and Zone E from the 3/8 inch x 0 test crushed to 30 mesh x 0. The data are shown in Tables 75 through 85.

To evaluate the nine Phase II coals for potential use in a high sulfur combustor, the chemical analysis data for each coal was tabulated according to the gravity separations performed on the 3/8 inch x 0 coal cleaning test fractions. Sample data sheets are shown in Tables 13 through 15.

In Table 13, the gravity separations were combined using a conventional three-split separation to obtain three products: a conventional or low sulfur combustor feedstock, a high sulfur combustor feedstock, and a refuse product. The low sulfur combustor feedstock should have a low total sulfur content and a high calorific value; ideally, the total sulfur content should be below one percent, but this level was not obtained in any of the present tests. The high sulfur combustor feedstock can have a higher sulfur content and a lower calorific value. The third product, refuse, contains high-ash, low-calorific value material. Composites of the fractions which compose the three products for each of the Phase II coals are shown in Table 16.

TABLE 12. SUMMARY OF SULFUR RECOVERY IN PYRITE CONCENTRATION TESTS

Coal Identification Lot	Seam	Total Sulfur, ROM Coal, Percent	Pyritic Sulfur, ROM Coal, Percent	Sulfur Reclaimed in Pyrite Concentrate, Percent		Total Sulfur, Pyrite Concentrate, Percent
				Total Sulfur	Pyritic Sulfur	
2546	Upper Freeport	2.14	1.60	6.1	8.1	47.4
2555	Pittsburgh	2.52	1.34	3.6	6.7	43.3
2556	Ohio No. 9	3.02	2.34	18.2	23.5	44.1
2574	Ohio No. 8	3.81	2.93	13.1	17.1	45.0
2579	Franklin L. B.	4.28	3.37	2.8	3.6	39.8
2630	Upper Freeport	2.32	1.77	23.7	31.1	45.9
2651	Illinois No. 6	3.45	2.56	8.1	10.9	45.9
2694	Ohio No. 5	6.88	6.04	15.9	18.1	42.0
2713	Upper Freeport	1.86	1.31	14.8	21.0	45.8
Averages		3.36	2.58	11.8	15.6	44.4

TABLE 13. POTENTIAL COMBUSTION USE OF SELECTED FRACTIONS FROM PHASE II COALS USING CONVENTIONAL THREE-SPLIT SEPARATION

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

BCR Lot No. 2546

Conventional or Low Sulfur Combustor Feedstock	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis			Available Calorific Value, Percent	Total Usable Product, Percent
		Ash	Total Sulfur	Calorific Value Btu/lb		
Zone A (assumed 1.60 Fl.)	38.6	5.99	0.92	14,478		
Zone B (assumed 1.60 Fl.)	33.3	6.53	1.06	14,366		
Zone C, 1.60 Fl.	7.4	13.1	2.30	13,222		
Composite of Fractions	79.3	6.88	1.11	14,314	93.5	90.0
High Sulfur Combustor Feedstock						
Zone C, 1.60 x 1.90	4.1	41.2	4.56	8,395		
Zone C, 1.90 Sk.	2.2	66.3	5.04	4,146		
Zone D, 1.90 Fl.	1.0	36.9	4.98	9,132		
Zone D, 2.95 Sk.	0.4	60.0	38.9	4,137		
Zone E, 2.95 Sk.	1.1	62.1	41.7	3,742		
Composite of Fractions	8.8	50.4	10.9	6,644	4.8	10.0
Refuse						
Zone D, 1.90 x 2.95	10.4	81.8	3.64	1,781		
Zone E, 2.95 Fl.	1.5	82.6	5.54	1,648		
Composite of Fractions	11.9	81.9	3.88	1,764	1.7	
Composite of Table Fractions	100.0	19.6	2.30	12,146		

TABLE 14. POTENTIAL COMBUSTION USE OF SELECTED FRACTIONS FROM PHASE II COALS USING "UNCONVENTIONAL" THREE-SPLIT SEPARATION

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

BCR Lot No. 2546

		Chemical Analysis, Weight Percent, Dry Basis				
Low Sulfur Combustor Feedstock	Product, Weight Percent	Ash	Total Sulfur	Calorific Value Btu/lb	Available Calorific Value, Percent	Total Usable Product, Percent
Zone A (assumed 1.60 Fl.)	38.6	5.99	0.92	14,478		
Zone B (assumed 1.60 Fl.)	33.3	6.53	1.06	14,366		
Composite of Fractions	71.9	6.24	0.98	14,426	85.4	81.6
High Sulfur Combustor Feedstock						
Zone C, 1.60 Fl.	7.4	13.1	2.30	13,222		
Zone C, 1.60 x 1.90	4.1	41.2	4.56	8,395		
Zone C, 1.90 Sk.	2.2	66.3	5.04	4,146		
Zone D, 1.90 Fl.	1.0	36.9	4.98	9,132		
Zone D, 2.95 Sk.	0.4	60.0	38.9	4,137		
Zone E, 2.95 Sk.	1.1	62.1	41.7	3,742		
Composite of Fractions	16.2	33.4	6.97	9,650	12.9	18.4
Refuse						
Zone D, 1.90 x 2.95	10.4	81.8	3.64	1,781		
Zone E, 2.95 Fl.	1.5	82.6	5.54	1,648		
Composite of Fractions	11.9	81.9	3.88	1,764	1.7	
Composite of Table Fractions	100.0	19.6	2.30	12,146		

TABLE 15. POTENTIAL COMBUSTION USE OF SELECTED FRACTIONS FROM PHASE II COALS USING CONVENTIONAL TWO-SPLIT SEPARATION

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

BCR Lot No. 2546

Conventional or Low Sulfur Combustor Feedstock	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis: Ash	Total Sulfur	Calorific Value Btu/lb	Available Calorific Value, Percent	Total Usable Product, Percent
Zone A (assumed 1.60 Fl.)	38.6	5.99	0.92	14,478		
Zone B (assumed 1.60 Fl.)	33.3	6.53	1.06	14,366		
Zone C, 1.60 Fl.	7.4	13.1	2.30	13,222		
Composite of Fractions	79.3	6.88	1.11	14,314	93.5	90.0
Refuse						
Zone C, 1.60 x 1.90	4.1	41.2	4.56	8,395		
Zone C, 1.90 Sk.	2.2	66.3	5.04	4,146		
Zone D, 1.90 Fl.	1.0	36.9	4.98	9,132		
Zone D, 2.95 Sk.	0.4	60.0	38.9	4,137		
Zone E, 2.95 Sk.	1.1	62.1	41.7	3,742		
Zone D, 1.90 x 2.95	10.4	81.8	3.64	1,781		
Zone E, 2.95 Fl.	1.5	82.6	5.54	1,648		
Composite of Fractions	20.7	68.5	6.86	3,838	6.5	10.0
Composite of Table Fractions	100.0	19.6	2.30	12,146		

TABLE 16. COMPOSITES OF POTENTIAL COMBUSTION FEEDSTOCKS FROM PHASE II COALS USING A CONVENTIONAL THREE-SPLIT SEPARATION

	BCR Lot No.	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis: Ash	Total Sulfur	Calorific Value, Btu/lb	Available Calorific Value, Percent	Total Usable Product, Percent
Composites of Fractions for Conventional or Low Sulfur Combustor Feedstock	2546	79.3	6.88	1.11	14,314	93.5	90.0
	2555	92.8	6.54	1.97	14,177	97.8	96.5
	2556	87.3	11.3	2.19	12,885	91.8	87.3
	2574	90.9	6.88	2.78	13,689	97.1	95.0
	2579	81.8	16.2	3.27	12,929	92.3	88.3
	2630	79.3	8.38	1.15	14,162	93.5	90.9
	2651	90.3	8.33	2.32	13,179	96.5	94.9
	2694	88.2	8.21	3.51	12,931	94.8	90.3
	2713	77.8	10.6	1.08	13,667	92.7	88.4
Composites of Fractions for High Sulfur Combustor Feedstock	2546	8.8	50.4	10.9	6,644	4.8	10.0
	2555	3.4	48.8	12.0	6,437	1.6	3.5
	2556	9.1	37.1	8.94	8,419	6.3	9.4
	2574	4.8	48.6	25.0	5,790	2.2	5.0
	2579	10.8	52.6	10.3	6,321	6.0	11.7
	2630	7.9	51.0	16.1	6,329	4.2	9.1
	2651	4.9	48.4	16.8	6,234	2.5	5.1
	2694	9.5	49.4	31.5	5,375	4.3	9.7
	2713	10.2	55.2	6.68	5,883	5.2	11.6
Composites of Fractions for Refuse	2546	11.9	81.9	3.88	1,764	1.7	--
	2555	3.8	74.6	5.19	2,010	0.6	--
	2556	3.6	49.2	6.15	6,668	1.9	--
	2574	4.3	76.0	7.07	2,267	0.7	--
	2579	7.4	75.4	7.38	2,719	1.7	--
	2630	12.8	78.2	5.03	2,162	2.3	--
	2651	4.8	69.9	9.92	2,714	1.0	--
	2694	2.3	56.6	22.4	4,917	0.9	--
	2713	12.0	78.7	2.76	2,003	2.1	--

In Table 14, the gravity separations were combined to form the same three products, but the method of combining the separations was altered slightly and labeled "unconventional." In order to decrease the percentage of ash and total sulfur content, and increase the calorific value of the low sulfur combustor feedstock, the 1.60 float fraction from Zone C was transferred from the low to the high sulfur combustor feedstock. By doing this, the total sulfur content of the low sulfur feedstock was reduced from 1.11 percent to 0.98 percent. However, both the percentage of available calorific value and the percentage of total usable material contained in the low sulfur combustor feedstock decreased by about 8 percent.

Table 15 presents the gravity separations that were combined using a conventional two-split separation to obtain only two products, a conventional or low sulfur combustor feedstock and a refuse product. This method would apply when only a low sulfur combustor was utilized. Composites of the fractions which compose the two products are shown in Table 17 for each of the Phase II coals.

It should be mentioned that the combination of the various gravity separation fractions is by no means a standard method. Instead, it is merely meant to be a very general guideline. In most cases, the optimum combination of these fractions will vary from coal to coal depending on whether quantity or quality of feed material for the combustor is stressed. Also, the terms "conventional" and "unconventional" are used merely to distinguish between two possible methods of combining the fractions.

The complete sulfur combustor data for the nine Phase II coals are shown in Appendix C, Tables C-1 through C-19.

IV. CONCLUSIONS

A. Phase I Evaluations

The coals evaluated during this period were quite different from the 20 coals evaluated during the calendar year 1969. The pyritic sulfur content of the ROM coals varied from 0.34 to 5.99 percent, and considerable progress was made in sulfur reduction by gravity separation in most of the coals. As usual, those coals which showed the least total sulfur reduction contained a high proportion of organic sulfur.

Additional data are needed to obtain a broader outlook on the effects of fine grinding on pyrite liberation for United States coals. Therefore, it is suggested that Phase I work be continued on coal seams and/or areas that have, with limited data, shown potential for this approach to air pollution control.

TABLE 17. COMPOSITES OF POTENTIAL COMBUSTION FEEDSTOCK FROM PHASE II COALS USING A CONVENTIONAL TWO-SPLIT SEPARATION

	BCR Lot No.	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis			Available Calorific Value, Percent	Total Usable Product, Percent
			Ash	Total Sulfur	Calorific Value, Btu/lb		
Composites of Fractions for Conventional or Low Sulfur Combustor Feedstock	2546	79.3	6.88	1.11	14,314	93.5	90.0
	2555	92.8	6.54	1.97	14,177	97.8	96.5
	2556	87.3	11.3	2.19	12,885	91.8	87.3
	2574	90.9	6.88	2.78	13,689	97.1	95.0
	2579	81.8	16.2	3.27	12,929	92.3	88.3
	2630	79.3	8.38	1.15	14,162	93.5	90.9
	2651	90.3	8.33	2.32	13,179	96.5	94.9
	2694	88.2	8.21	3.51	12,931	94.8	90.3
	2713	77.8	10.6	1.08	13,667	92.7	88.4
Composites of Fractions for Refuse	2546	20.7	68.5	6.86	3,838	6.5	10.0
	2555	7.2	62.4	8.42	4,100	2.2	3.5
	2556	12.7	40.5	8.16	7,922	8.2	12.7
	2574	9.1	61.5	16.5	4,129	2.9	5.0
	2579	18.2	61.9	9.11	4,855	7.7	11.7
	2630	20.7	67.8	9.25	3,754	6.5	9.1
	2651	9.7	59.0	13.4	4,490	3.5	5.1
	2694	11.8	50.8	29.8	5,280	5.2	9.7
	2713	22.2	67.9	4.54	3,786	7.3	11.6

B. Phase II Evaluations

The results obtained from the Phase II, Coal Cleaning and Pyrite Concentration Studies, differed somewhat from those obtained in previous test series. The average total sulfur in the ROM coals was slightly less than that for the six previous Phase II coals, and the average pyritic sulfur was very similar. However, the nine present Phase II coals were not as amenable to the coal cleaning and pyrite concentration processes as were the previous coals. The situation was further complicated by the fact that the average organic sulfur content (ROM) of the present coals was considerably less than that of the previous coals.

The only variable introduced into the two coal cleaning tests on the quarter-size concentrating table was that the end table elevation (refuse end) was increased from 1 inch to 1-1/2 inches in 8 feet. The elevation was increased in order to effect a better distribution over the entire table, especially when cleaning high-refuse coals.

In the Pyrite Concentration Tests, the percent sulfur reclaimed in the pyrite concentrate, both total and pyritic, was considerably less than for the previous coals tested.

In the Sulfur Combustor Studies, seven of the nine coals studied showed possibilities for use in a high-sulfur combustor, in line with the total seam utilization concept. It should be emphasized that these coals appeared promising when evaluated under very general guidelines.

It is recommended that further Phase II evaluations be continued in conjunction with Sulfur Combustor Studies.

Appendix A

PHASE I EVALUATIONS--FLOAT-SINK TESTS

Moisture as reported on all Tables is the moisture of the sample as received in the analytical laboratory. This value is used to place other analyses on a dry basis.

TABLE A-1

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Coal Identification Upper Freeport Seam, Preston County, West Virginia
Raw Run-of-Mine Coal Crushed to 1-1/2 Inch x 0

BCR Lot No. 2437

Chemical Analysis, As Received:

	Weight %, Dry Basis							
Moisture	Ash	Volatile Matter	Fixed Carbon	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Calorific Value, Btu/lb
1.41	19.2	28.4	52.4	2.47	0.12	1.93	0.42	12,494

Analyses of As-received Sample Reduced to Minus 30 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	79.6	6.90	0.82	0.27	86.0	66.8
Sink at 1.60	20.4	65.7	8.60	8.19		
Composite	100.0	18.90	2.41	1.89		

Analyses of As-received Sample Reduced to Minus 200 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	77.9	6.32	0.73	0.18	90.7	70.0
Sink at 1.60	22.1	64.3	8.64	8.13		
Composite	100.0	19.13	2.48	1.94		

TABLE A-2

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Coal Identification No. 6 Seam, Tuscarawas County, Ohio

Raw Run-of-Mine Coal Crushed to 1-1/2 Inch x 0

BCR Lot No. 2438

Chemical Analysis, As Received:

	Weight %, Dry Basis							
Moisture	Ash	Volatile Matter	Fixed Carbon	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Calorific Value, Btu/lb
4.77	7.76	43.1	49.1	4.46	0.15	3.57	0.74	13,448

Analyses of As-received Sample Reduced to Minus 30 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	91.3	2.93	2.12	1.37	61.6	52.5
Sink at 1.60	8.7	54.4	27.4	-- *		
Composite	100.0	7.41	4.32	--		

Analyses of As-received Sample Reduced to Minus 200 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	89.8	2.28	1.82	1.07	70.0	59.2
Sink at 1.60	10.2	51.5	26.8	25.9		
Composite	100.0	7.30	4.37	3.60		

* Analysis Omitted, Insufficient Sample

TABLE A-3

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Coal Identification No. 9 Seam, Muhlenburg County, Kentucky
Raw Run-of-Mine Coal Crushed to 1-1/2 Inch x 0

BCR Lot No. 2439

Chemical Analysis, As Received:

	Weight %, Dry Basis							
Moisture	Ash	Volatile Matter	Fixed Carbon	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Calorific Value, Btu/lb
6.42	9.44	41.7	48.9	4.28	0.21	2.89	1.18	12,973

Analyses of As-received Sample Reduced to Minus 30 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	92.1	5.92	2.94	1.80	37.7	31.3
Sink at 1.60	7.9	49.1	20.4	-- *		
Composite	100.0	9.33	4.32	--		

Analyses of As-received Sample Reduced to Minus 200 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	90.2	4.58	2.50	1.46	49.5	41.6
Sink at 1.60	9.8	48.4	19.3	17.6		
Composite	100.0	8.87	4.15	3.04		

* Analysis Omitted, Insufficient Sample

TABLE A-4

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Coal Identification Black Creek Seam, Jefferson County, Alabama
Raw Run-of-Mine Coal Crushed to 1-1/2 Inch x 0

BCR Lot No. 2440

Chemical Analysis, As Received:

	Weight %, Dry Basis							
Moisture	**Ash**	**Volatile Matter**	**Fixed Carbon**	**Total Sulfur**	**Sulfate Sulfur**	**Pyritic Sulfur**	**Organic Sulfur**	**Calorific Value, Btu/lb**
1.08	6.71	31.9	61.4	0.93	0.06	0.34	0.53	14,524

Analyses of As-received Sample Reduced to Minus 30 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	**Ash**	**Total Sulfur**	**Pyritic Sulfur**	**Pyritic Sulfur**	**Total Sulfur**
Float at 1.60	92.4	2.06	0.70	0.08	76.5	24.7
Sink at 1.60	7.6	62.4	3.27	-- *		
Composite	100.0	6.65	0.90	-- *		

Analyses of As-received Sample Reduced to Minus 200 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	**Ash**	**Total Sulfur**	**Pyritic Sulfur**	**Pyritic Sulfur**	**Total Sulfur**
Float at 1.60	91.6	2.01	0.70	0.19	44.1	24.7
Sink at 1.60	8.4	56.9	2.86	2.33		
Composite	100.0	6.62	0.88	0.37		

* Analysis Omitted, Insufficient Sample

TABLE A-5

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Coal Identification No. 5 Seam, Tuscarawas County, Ohio
Raw Run-of-Mine Coal Crushed to 1-1/2 Inch x 0

BCR Lot No. 2441

Chemical Analysis, As Received:

	Weight %, Dry Basis							
Moisture	Ash	Volatile Matter	Fixed Carbon	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Calorific Value, Btu/lb
4.78	12.6	40.2	47.2	7.15	0.27	5.99	0.92	12,388

Analyses of As-received Sample Reduced to Minus 30 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	84.0	3.71	3.12	2.12	64.6	56.4
Sink at 1.60	16.0	53.3	25.2	24.3		
Composite	100.0	11.64	6.65	5.67		

Analyses of As-received Sample Reduced to Minus 200 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	83.1	2.83	2.56	1.59	73.5	64.2
Sink at 1.60	16.9	57.1	28.4	27.6		
Composite	100.0	12.00	6.93	5.99		

TABLE A-6

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Coal Identification Upper Freeport Seam, Preston County, West Virginia
Raw Run-of-Mine Coal Crushed to 1-1/2 Inch x 0

BCR Lot No. 2442

Chemical Analysis, As Received:

	Weight %, Dry Basis							
Moisture	Ash	Volatile Matter	Fixed Carbon	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Calorific Value, Btu/lb
0.90	14.2	26.6	59.2	1.38	0.12	0.82	0.44	13,176

Analyses of As-received Sample Reduced to Minus 30 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	85.9	6.25	0.62	0.06	92.7	55.1
Sink at 1.60	14.1	66.8	5.42	4.79		
Composite	100.0	14.79	1.30	0.73		

Analyses of As-received Sample Reduced to Minus 200 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	83.7	5.27	0.66	0.12	85.3	52.2
Sink at 1.60	16.3	59.8	5.46	4.97		
Composite	100.0	14.16	1.44	0.91		

TABLE A-7

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Coal Identification Wadge Seam, Routt County, Colorado
Raw Run-of-Mine Coal Crushed to 1-1/2 Inch x 0

BCR Lot No. 2443

Chemical Analysis, As Received:

	Weight %, Dry Basis							
Moisture	Ash	Volatile Matter	Fixed Carbon	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Calorific Value, Btu/lb
4.26	9.48	40.4	50.1	0.54	--	0.30	0.24	12,410

Analyses of As-received Sample Reduced to Minus 30 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	96.5	7.90	0.44	0.18	40.0	18.5
Sink at 1.60	3.5	45.2	1.30	-- *		
Composite	100.0	9.21	0.47	--		

Analyses of As-received Sample Reduced to Minus 200 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	93.5	6.87	0.50	0.24	20.0	7.4
Sink at 1.60	6.5	41.4	1.02	0.76		
Composite	100.0	9.11	0.53	0.27		

* Analysis Omitted, Insufficient Sample

TABLE A-8

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Coal Identification Baxter Seam, Crawford County, Kansas

Raw Run-of-Mine Coal Crushed to 1-1/2 Inch x 0

BCR Lot No. 2444

Chemical Analysis, As Received:

	Weight %, Dry Basis							
Moisture	Ash	Volatile Matter	Fixed Carbon	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Calorific Value, Btu/lb
1.24	30.9	30.4	38.7	4.43	0.38	3.33	0.72	10,066

Analyses of As-received Sample Reduced to Minus 30 Mesh:

	Float & Sink Weight, %	Chemical Analysis, Dry Basis			Weight, % Reduction	
		Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	66.0	9.29	2.81	1.79	46.2	36.6
Sink at 1.60	34.0	71.4	7.50	6.37		
Composite	100.0	30.41	4.41	3.35		

Analyses of As-received Sample Reduced to Minus 200 Mesh:

	Float & Sink Weight, %	Chemical Analysis, Dry Basis			Weight, % Reduction	
		Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	64.3	8.36	2.10	1.08	67.6	52.6
Sink at 1.60	35.7	70.8	8.74	7.49		
Composite	100.0	30.65	4.47	3.37		

TABLE A-9

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Coal Identification No. 9 Seam, Ohio County, Kentucky
Raw Run-of-Mine Coal Crushed to 1-1/2 Inch x 0

BCR Lot No. 2445

Chemical Analysis, As Received:

	Weight %, Dry Basis							
Moisture	Ash	Volatile Matter	Fixed Carbon	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Calorific Value, Btu/lb
1.86	14.0	39.0	47.0	4.00	0.16	2.77	1.07	12,282

Analyses of As-received Sample Reduced to Minus 30 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	88.9	6.65	3.01	1.83	33.9	24.7
Sink at 1.60	11.1	64.7	10.8	--*		
Composite	100.0	13.09	3.88	--		

Analyses of As-received Sample Reduced to Minus 200 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	85.5	5.67	2.55	1.29	53.4	36.2
Sink at 1.60	14.5	59.8	12.6	11.7		
Composite	100.0	13.52	4.01	2.80		

* Analysis Omitted, Insufficient Sample

TABLE A-10

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Coal Identification No. 3A Seam, Tuscarawas County, Ohio
Raw Run-of-Mine Coal Crushed to 1-1/2 Inch x 0

BCR Lot No. 2446

Chemical Analysis, As Received:

	Weight %, Dry Basis							
Moisture	Ash	Volatile Matter	Fixed Carbon	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Calorific Value, Btu/lb
2.07	7.52	41.4	51.1	2.69	0.12	2.28	0.29	13,448

Analyses of As-received Sample Reduced to Minus 30 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	93.2	3.62	0.65	0.27	88.2	75.8
Sink at 1.60	6.8	55.2	26.2	-- *		
Composite	100.0	7.13	2.39	--		

Analyses of As-received Sample Reduced to Minus 200 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	92.2	3.32	0.65	0.25	89.0	75.8
Sink at 1.60	7.8	51.7	23.8	23.1		
Composite	100.0	7.09	2.46	2.03		

* Analysis Omitted, Insufficient Sample

TABLE A-11

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Coal Identification Lower Freeport Seam, Butler County, Pennsylvania
Raw Run-of-Mine Coal Crushed to 1-1/2 Inch x 0

BCR Lot No. 2447

Chemical Analysis, As Received:

	Weight %, Dry Basis							
Moisture	Ash	Volatile Matter	Fixed Carbon	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Calorific Value, Btu/lb
2.28	14.0	33.0	53.0	2.20	0.09	1.55	0.56	12,716

Analyses of As-received Sample Reduced to Minus 30 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	88.1	9.27	0.92	0.37	76.1	58.2
Sink at 1.60	11.9	47.0	10.6	--*		
Composite	100.0	13.76	2.07	--		

Analyses of As-received Sample Reduced to Minus 200 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	85.3	7.83	0.73	0.15	90.3	66.8
Sink at 1.60	14.7	48.1	10.6	9.96		
Composite	100.0	13.75	2.18	1.59		

* Analysis Omitted, Insufficient Sample

TABLE A-12

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Coal Identification No. 8 Seam, Belmont County, Ohio
Raw Run-of-Mine Coal Crushed to 1-1/2 Inch x 0

BCR Lot No. 2448

Chemical Analysis, As Received:

	Weight %, Dry Basis							
Moisture	Ash	Volatile Matter	Fixed Carbon	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Calorific Value, Btu/lb
1.58	12.4	42.0	45.6	5.06	0.25	3.35	1.46	12,638

Analyses of As-received Sample Reduced to Minus 30 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	89.3	7.89	3.83	2.29	31.6	24.3
Sink at 1.60	10.7	49.6	14.6	13.2		
Composite	100.0	12.35	4.98	3.46		

Analyses of As-received Sample Reduced to Minus 200 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	86.2	6.43	3.37	1.82	45.7	33.4
Sink at 1.60	13.8	47.8	15.2	13.9		
Composite	100.0	12.14	5.00	3.49		

TABLE A-13

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Coal Identification No. 12 Seam, Muhlenburg County, Kentucky
Raw Run-of-Mine Coal Crushed to 1-1/2 Inch x 0

BCR Lot No. 2449

Chemical Analysis, As Received:

	Weight %, Dry Basis							
Moisture	Ash	Volatile Matter	Fixed Carbon	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Calorific Value, Btu/lb
1.98	15.2	38.3	46.5	4.08	0.20	3.16	0.72	12,008

Analyses of As-received Sample Reduced to Minus 30 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	85.8	8.64	2.35	1.61	49.1	42.4
Sink at 1.60	14.2	56.0	15.0	13.9		
Composite	100.0	15.37	4.15	3.36		

Analyses of As-received Sample Reduced to Minus 200 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	84.5	7.58	1.95	1.20	62.0	52.2
Sink at 1.60	15.5	54.6	15.2	14.3		
Composite	100.0	14.87	4.00	3.23		

TABLE A-14

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Coal Identification Upper Freeport Seam, Preston County, West Virginia
Raw Run-of-Mine Coal Crushed to 1-1/2 Inch x 0

BCR Lot No. 2450

Chemical Analysis, As Received:

	Weight %, Dry Basis							
Moisture	Ash	Volatile Matter	Fixed Carbon	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Calorific Value, Btu/lb
1.02	18.2	28.2	53.6	2.44	0.26	1.71	0.47	12,413

Analyses of As-received Sample Reduced to Minus 30 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	81.5	8.01	0.85	0.27	84.2	65.2
Sink at 1.60	18.5	63.0	8.40	7.79		
Composite	100.0	18.18	2.25	1.66		

Analyses of As-received Sample Reduced to Minus 200 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	79.0	6.82	0.74	0.14	91.8	69.7
Sink at 1.60	21.0	60.8	8.18	7.59		
Composite	100.0	18.16	2.30	1.70		

TABLE A-15

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Coal Identification No. 9 Seam, Hopkins County, Kentucky
Raw Run-of-Mine Coal Crushed to 1-1/2 Inch x 0

BCR Lot No. 2476

Chemical Analysis, As Received:

Weight %, Dry Basis								
Moisture	Ash	Volatile Matter	Fixed Carbon	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Calorific Value, Btu/lb
3.08	9.48	43.4	47.1	3.98	0.12	2.20	1.66	13,237

Analyses of As-received Sample Reduced to Minus 30 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	92.0	4.72	3.30	1.52	30.9	17.1
Sink at 1.60	8.0	63.8	11.9	--*		
Composite	100.0	9.45	3.99	--		

Analyses of As-received Sample Reduced to Minus 200 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	91.1	4.32	3.16	1.57	28.6	20.6
Sink at 1.60	8.9	57.6	12.2	10.8		
Composite	100.0	9.06	3.96	2.39		

* Analysis Omitted, Insufficient Sample

TABLE A-16

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Coal Identification No. 9 Seam, Hopkins County, Kentucky
Raw Run-of-Mine Coal Crushed to 1-1/2 Inch x 0

BCR Lot No. 2477

Chemical Analysis, As Received:

Weight %, Dry Basis								
Moisture	Ash	Volatile Matter	Fixed Carbon	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Calorific Value, Btu/lb
3.51	14.9	38.8	46.3	3.83	0.09	2.72	1.02	12,149

Analyses of As-received Sample Reduced to Minus 30 Mesh:

	Float & Sink Weight, %	Chemical Analysis, Dry Basis			Weight, % Reduction	
		Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	87.2	6.49	2.54	1.46	46.3	33.7
Sink at 1.60	12.8	62.6	11.0	10.3		
Composite	100.0	13.67	3.62	2.59		

Analyses of As-received Sample Reduced to Minus 200 Mesh:

	Float & Sink Weight, %	Chemical Analysis, Dry Basis			Weight, % Reduction	
		Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	85.2	6.02	2.33	1.19	56.2	39.2
Sink at 1.60	14.8	60.9	12.1	11.3		
Composite	100.0	14.14	3.78	2.69		

TABLE A-17

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Coal Identification No. 6 Seam, Butler County, Kentucky
Raw Run-of-Mine Coal Crushed to 1-1/2 Inch x 0

BCR Lot No. 2478

Chemical Analysis, As Received:

	Weight %, Dry Basis							
Moisture	Ash	Volatile Matter	Fixed Carbon	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Calorific Value, Btu/lb
3.80	15.6	37.4	47.0	4.48	0.24	3.85	0.39	12,031

Analyses of As-received Sample Reduced to Minus 30 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	81.3	3.26	1.12	0.56	85.5	75.0
Sink at 1.60	18.7	63.1	17.8	17.0		
Composite	100.0	14.45	4.24	3.63		

Analyses of As-received Sample Reduced to Minus 200 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	81.1	3.63	1.05	0.46	88.1	76.5
Sink at 1.60	18.9	62.1	18.4	17.7		
Composite	100.0	14.68	4.33	3.72		

TABLE A-18

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Coal Identification Upper Freeport Seam, Preston County, West Virginia
Raw Run-of-Mine Coal Crushed to 1-1/2 Inch x 0

BCR Lot No. 2479

Chemical Analysis, As Received:

Weight %, Dry Basis								
Moisture	Ash	Volatile Matter	Fixed Carbon	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Calorific Value, Btu/lb
0.52	20.8	23.5	55.7	2.10	0.06	1.48	0.56	12,103

Analyses of As-received Sample Reduced to Minus 30 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	78.0	8.52	1.07	0.34	77.0	49.0
Sink at 1.60	22.0	62.7	5.36	4.91		
Composite	100.0	20.44	2.01	1.35		

Analyses of As-received Sample Reduced to Minus 200 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	75.1	7.24	0.89	0.15	89.9	57.6
Sink at 1.60	24.9	60.4	5.86	5.44		
Composite	100.0	20.48	2.13	1.47		

TABLE A-19

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Coal Identification No. 14 Seam, Hopkins County, Kentucky
Raw Run-of-Mine Coal Crushed to 1-1/2 Inch x 0

BCR Lot No. 2480

Chemical Analysis, As Received:

Moisture	Weight %, Dry Basis Ash	Volatile Matter	Fixed Carbon	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Calorific Value, Btu/lb
2.50	20.4	35.3	44.3	3.68	0.20	2.92	0.56	11,360

Analyses of As-received Sample Reduced to Minus 30 Mesh:

	Float & Sink Weight, %	Chemical Analysis, Dry Basis: Ash	Total Sulfur	Pyritic Sulfur	Weight, % Reduction: Pyritic Sulfur	Total Sulfur
Float at 1.60	77.9	5.98	2.12	1.47	49.7	42.4
Sink at 1.60	22.1	71.6	8.87	8.12		
Composite	100.0	20.48	3.61	2.94		

Analyses of As-received Sample Reduced to Minus 200 Mesh:

	Float & Sink Weight, %	Chemical Analysis, Dry Basis: Ash	Total Sulfur	Pyritic Sulfur	Weight, % Reduction: Pyritic Sulfur	Total Sulfur
Float at 1.60	77.3	5.50	1.76	1.02	65.1	52.2
Sink at 1.60	22.7	67.7	9.78	9.02		
Composite	100.0	19.62	3.58	2.84		

TABLE A-20

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Coal Identification Fire Clay Seam, Crawford County, Kansas
Raw Run-of-Mine Coal Crushed to 1-1/2 Inch x 0

BCR Lot No. 2481

Chemical Analysis, As Received:

	Weight %, Dry Basis							
Moisture	Ash	Volatile Matter	Fixed Carbon	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Calorific Value, Btu/lb
1.83	33.8	30.0	36.2	4.18	0.30	3.28	0.60	9,652

Analyses of As-received Sample Reduced to Minus 30 Mesh:

	Float & Sink Weight, %	Chemical Analysis, Dry Basis Ash	 Total Sulfur	 Pyritic Sulfur	Weight, % Reduction Pyritic Sulfur	 Total Sulfur
Float at 1.60	63.3	9.88	2.84	1.96	40.2	32.1
Sink at 1.60	36.7	72.5	6.38	5.50		
Composite	100.0	32.86	4.14	3.26		

Analyses of As-received Sample Reduced to Minus 200 Mesh:

	Float & Sink Weight, %	Chemical Analysis, Dry Basis Ash	 Total Sulfur	 Pyritic Sulfur	Weight, % Reduction Pyritic Sulfur	 Total Sulfur
Float at 1.60	61.9	10.2	2.31	1.35	58.8	44.7
Sink at 1.60	38.1	69.6	7.41	6.47		
Composite	100.0	32.83	4.25	3.30		

TABLE A-21

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Coal Identification No. 6 Seam, Hopkins County, Kentucky
Raw Run-of-Mine Coal Crushed to 1-1/2 Inch x 0

BCR Lot No. 2482

Chemical Analysis, As Received:

	Weight %, Dry Basis							
Moisture	Ash	Volatile Matter	Fixed Carbon	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Calorific Value, Btu/lb
4.30	9.60	36.8	53.6	2.28	0.25	1.53	0.50	12,992

Analyses of As-received Sample Reduced to Minus 30 Mesh:

	Float & Sink Weight, %	Chemical Analysis, Dry Basis			Weight, % Reduction	
		Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	89.8	3.00	1.40	0.67	56.2	38.6
Sink at 1.60	10.2	64.8	9.72	9.04		
Composite	100.0	9.30	2.25	1.52		

Analyses of As-received Sample Reduced to Minus 200 Mesh:

	Float & Sink Weight, %	Chemical Analysis, Dry Basis			Weight, % Reduction	
		Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	88.9	2.80	1.26	0.55	64.1	44.7
Sink at 1.60	11.1	59.6	9.30	8.56		
Composite	100.0	9.10	2.15	1.44		

TABLE A-22

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Coal Identification No. 9 Seam, Davies County, Kentucky
Raw Run-of-Mine Coal Crushed to 1-1/2 Inch x 0

BCR Lot No. 2483

Chemical Analysis, As Received:

	Weight %, Dry Basis							
Moisture	Ash	Volatile Matter	Fixed Carbon	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Calorific Value, Btu/lb
5.74	15.2	38.4	46.4	4.10	0.14	3.13	0.83	11,992

Analyses of As-received Sample Reduced to Minus 30 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	85.2	6.12	2.29	1.37	56.2	44.1
Sink at 1.60	14.8	61.6	13.5	12.8		
Composite	100.0	14.33	3.95	3.06		

Analyses of As-received Sample Reduced to Minus 200 Mesh:

		Chemical Analysis, Dry Basis			Weight, % Reduction	
	Float & Sink Weight, %	Ash	Total Sulfur	Pyritic Sulfur	Pyritic Sulfur	Total Sulfur
Float at 1.60	84.0	6.11	2.20	1.27	59.4	46.3
Sink at 1.60	16.0	58.4	13.6	12.8		
Composite	100.0	14.48	4.02	3.11		

Appendix B

PHASE II EVALUATIONS--CONCENTRATING TABLE AND PYRITE BENEFICIATION

Moisture as reported on all Tables is the moisture of the sample as received in the analytical laboratory. This value is used to place other analyses on a dry basis.

TABLE B-1

SCREEN ANALYSIS

Coal Identification Upper Freeport Seam, Armstrong County, Pa.

BCR Sample No. 2546

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

Screen Size	Weight Percent	Cumulative
plus 1/4 in.	9.7	9.7
1/4 in. x 6 M	28.1	37.8
6 M x 12 M	22.8	60.6
minus 12 M	39.4	100.0
Total	100.0	

Zones A, B and C from 3/8 Inch x 0 Run (4-9-70) Crushed to 30 Mesh x 0

Screen Size	Weight Percent	Cumulative
plus 30 M	3.7	3.7
30 M x 50 M	32.7	36.4
50 M x 100 M	26.5	62.9
minus 100 M	37.1	100.0
Total	100.0	

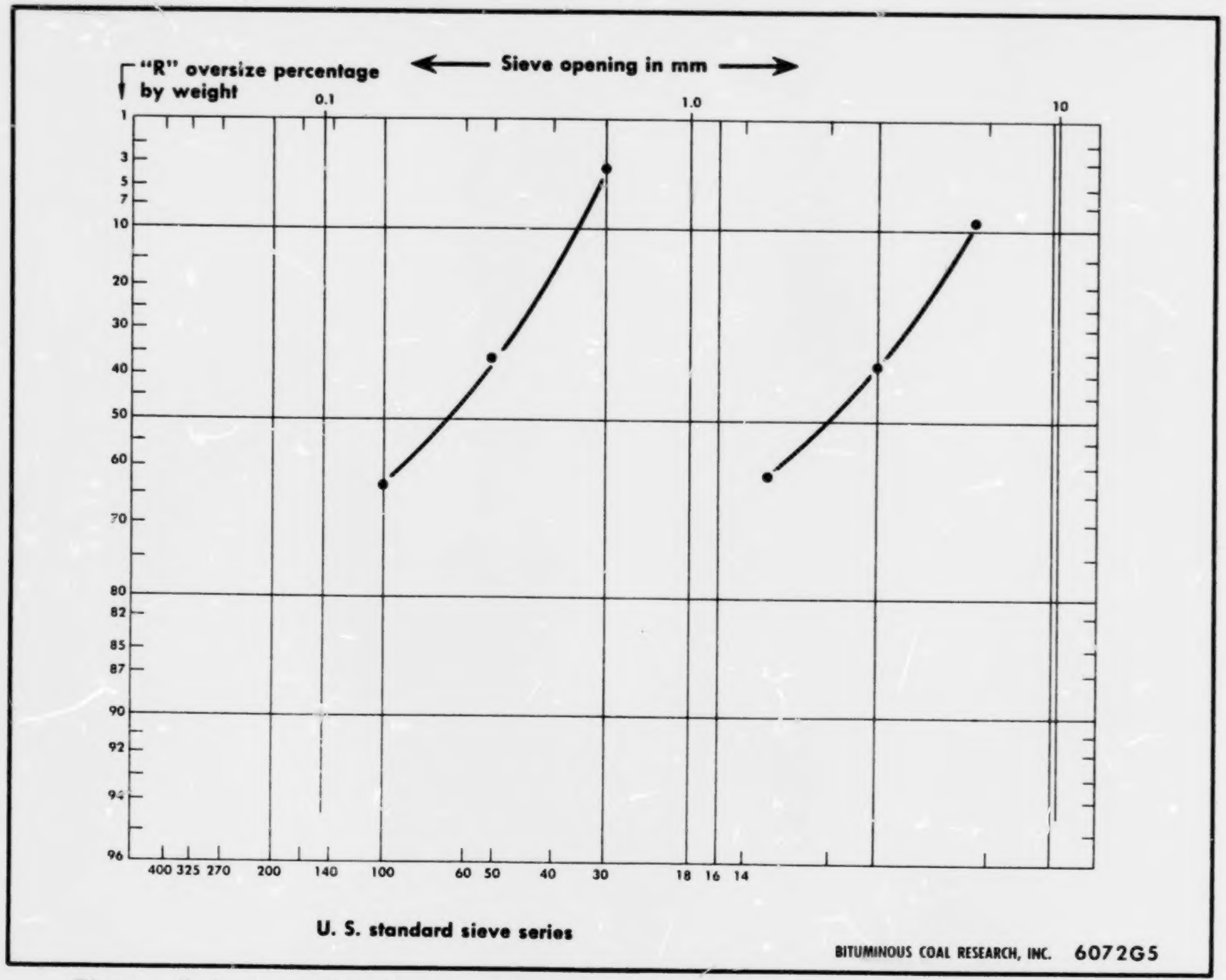

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Figure B-1. Size Distribution Curves of 30 Mesh X 0 and 3/8 Inch X 0 Concentrating Table Feeds for Upper Freeport Seam, Armstrong County, Pennsylvania, BCR Sample No. 2546

TABLE B-2

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--3/8 Inch x 0 Rough Cleaning and Pyrite Precleaning

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

BCR Sample No. 2546

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	38.6		0.80	5.99	0.92	
Zone B	33.3		0.64	6.53	1.06	
Zone C						
Float at 1.60	7.4	54.3	0.68	13.1	2.30	
1.60 by 1.90	4.1	29.7	0.84	41.2	4.56	44.6
Sink at 1.90	2.2	16.0	0.76	66.3	5.04	23.5
Composite	13.7	100.0		30.0	3.41	
Zone D						
Float at 1.90	1.0	8.3	0.72	36.9	4.98	44.7
1.90 by 2.95	10.4	88.0	0.77	81.8	3.64	9.2
Sink at 2.95	0.4	3.7	0.41	60.0	38.9	----*
Composite	11.8	100.0		77.3	5.06	
Zone E						
Float at 2.95	1.5	58.5	0.64	82.6	5.54	
Sink at 2.95	1.1	41.5	0.30	62.1	41.7	
Composite	2.6	100.0		74.1	20.5	
Composite of Zones A, B, C	85.6			10.0	1.37	
Composite of 1.60 Float Fractions	79.3			6.88	1.11	
Composite of 2.95 Sink Fractions	1.5			61.5	41.0	
Composite of Table Products	100.0			19.6	2.31	
Analysis of Feed to Table			1.50	18.6	2.14	

Run Date: 4-9-70

*Analysis omitted, insufficient sample

TABLE B-3

Evaluation of Coal Cleaning Processes and Techniques
for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--30 Mesh x 0 Deep Cleaning

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

Zones A, B, and C, 3/8 Inch x 0 Run (4-9-70) Crushed to 30 Mesh x 0

BCR Sample No. 2546

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	66.1		0.48	6.30	0.96	
Zone B	23.8		0.44	7.37	1.02	
Zone C						
Float at 1.60	2.9	84.2	0.60	17.3	1.99	
Sink at 1.60	0.5	15.8	0.60	47.6	5.20	
Composite	3.4	100.0		22.1	2.50	
Zone D						
Float at 1.60	1.2	20.2	0.56	25.9	3.30	
1.60 by 2.95	4.8	78.2	0.31	52.9	4.70	
Sink at 2.95	0.1	1.6	0.29	63.2	37.2	
Composite	6.1	100.0		47.6	4.94	
Zone E						
Float at 2.95	0.25	42.4	0.42	74.1	10.6	
Sink at 2.95	0.35	57.6	0.20	62.7	41.4	
Composite	0.60	100.0		67.5	28.3	
Composite of Zones A, B, C	93.3			7.14	1.03	
Composite of 1.60 Float Fractions	94.0			7.17	1.04	
Composite of 2.95 Sink Fractions	0.5			62.81	40.5	
Composite of Table Products	100.0			9.98	1.43	
Analysis of Feed to Table			1.45	10.1	1.49	

Run Date: 4-16-70

TABLE B-4

Evaluation of Coal Cleaning Processes and Techniques
for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--Effects of Two-stage Cleaning

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

Composite of 3/8 Inch x 0 Run (4-9-70) and 30 Mesh x 0 Run (4-16-70)

BCR Sample No. 2546

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	56.6			6.30	0.96	
Zone B	20.4			7.37	1.02	
Zone C						
Float at 1.60	2.4	84.2		17.3	1.99	
Sink at 1.60	0.5	15.8		47.6	5.20	
Composite	2.9	100.0		22.1	2.50	
Zone D						
Float at 2.95	16.5	97.1		68.4	4.02	
Sink at 2.95	0.5	2.9		60.6	38.6	
Composite	17.0	100.0		68.2	5.02	
Zone E						
Float at 2.95	1.7	54.8		81.6	6.14	
Sink at 2.95	1.4	45.2		62.2	41.6	
Composite	3.1	100.0		72.8	22.2	
Composite of Zones A, B, C	79.9			7.14	1.03	
Composite of 1.60 Float Fractions	79.4			6.90	1.01	
Composite of 2.95 Sink Fractions	1.9			61.8	40.8	
Composite of Table Products	100.0			19.6	2.37	
Analysis of Feed to Table				18.6	2.14	

TABLE B-5

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table No. 15-S Tests - Pyrite Beneficiation

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

Zone E, 3/8 Inch x 0 Run (4-9-70) Crushed to 30 Mesh x 0

BCR Sample No. 2546

Table Products	Product, Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
		Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	9.9	0.24	68.8	13.0	
Zone B	19.5	0.32	76.8	6.90	
Zone C	44.2	0.12	81.5	11.4	
Zone D	15.8	0.11	65.7	41.3	5.9
Zone E	10.6	0.10	64.6	47.4	3.9
Composite of Table Products	100.0		75.04	19.22	
Analysis of Feed to Table			75.2	19.2	

Run Date: 4-24-70

TABLE B-6

Evaluation of Coal Cleaning Processes and Techniques
for Removing Pyritic Sulfur from Fine Coal

Concentrating Table No. 15-S Tests - Pyrite Beneficiation

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

Zone D, 30 Mesh x 0 Run (4-24-70) Crushed to 60 Mesh x 0

BCR Sample No. 2546

Table Products	Product, Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
		Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	14.5	0.16	65.8	39.6	
Zone B	33.7	0.16	65.6	39.4	
Zone C	47.8	0.18	65.8	40.2	
Zone D	1.7	0.18	66.5	43.2	3.8
Zone E	2.3	0.14	66.2	48.0	2.2
Composite of Table Products	100.0		65.8	40.1	
Analysis of Feed to Table			65.7	41.3	

Run Date: 4-28-70

TABLE B-7

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Pyrite Beneficiation - Effects of Two-stage Cleaning

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

BCR Sample No. 2546

Pyrite Precleaning

Concentrating Table No. 14 Test Run Date 4-9-70
Feed to Concentrating Table: Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	18.6	2.14
Zone E (Pyrite Zone)	2.6	74.1	20.5

Pyrite Cleaning

Concentrating Table No. 15-S Test Run Date 4-24-70
Feed to Concentrating Table: Zone E, 3/8 Inch x 0 Run (4-9-70) Crushed to 30 Mesh x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	75.2	19.2
Zone E (Pyrite Zone)	10.6	64.6	47.4

Concentrating Table No. 15-S Test Run Date 4-28-70
Feed to Concentrating Table: Zone D, 30 Mesh x 0 Run (4-24-70) Crushed to 60 Mesh x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	65.7	41.3
Zone E (Pyrite Zone)	2.3	66.2	48.0

Two Stage Pyrite Product	0.28	64.7	47.4

TABLE B-8

Flowsheet for Pyrite Beneficiation Tests

Upper Freeport Seam, Armstrong County, Pa.
BCR Sample No. 2546
Basis:
Pounds of Total Sulfur/Ton of
Run-of-Mine Coal

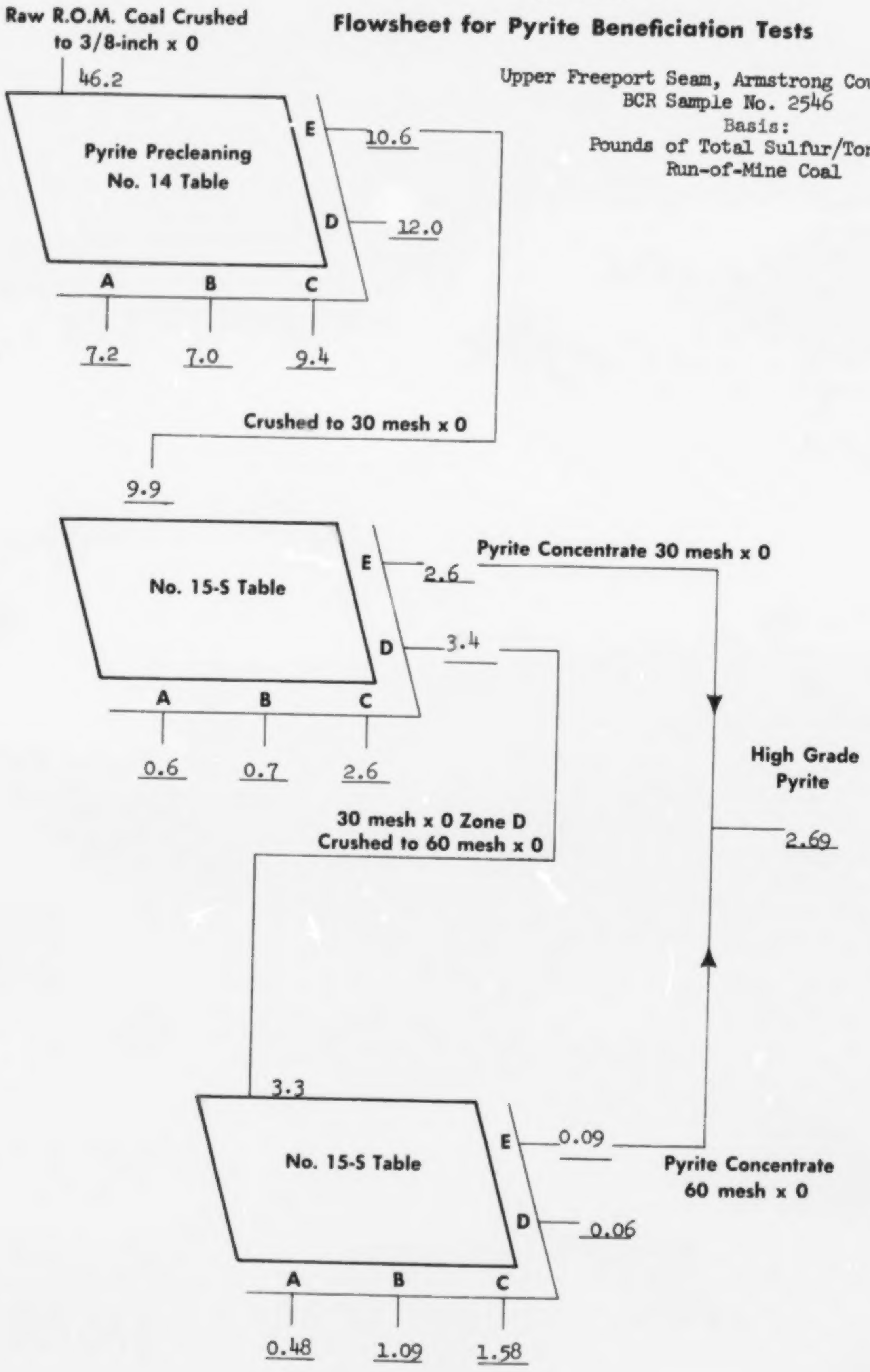

Raw R.O.M. Coal Crushed to 3/8-inch x 0
46.2
Pyrite Precleaning No. 14 Table
E
10.6
D
12.0
A
B
C
7.2
7.0
9.4
Crushed to 30 mesh x 0
9.9
No. 15-S Table
E
2.6
Pyrite Concentrate 30 mesh x 0
D
3.4
A
B
C
0.6
0.7
2.6
High Grade Pyrite
2.69
30 mesh x 0 Zone D Crushed to 60 mesh x 0
3.3
No. 15-S Table
E
0.09
Pyrite Concentrate 60 mesh x 0
D
0.06
A
B
C
0.48
1.09
1.58

TABLE B-9

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Flowsheet Data for Pyrite Beneficiation Tests

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

BCR Sample No. 2546

Fraction	Weight Percent		Chemical Analysis, Dry Basis Weight Percent	
			Ash	Total Sulfur
Table No. 14				
Zone A	38.6		5.99	0.92
Zone B	33.3		6.53	1.06
Zone C	13.7		30.0	3.41
Zone D	11.8		77.3	5.06
Zone E		2.6	74.1	20.5
Table No. 15-S (30 Mesh x 0)				
Zone A	0.26		68.8	13.0
Zone B	0.51		76.8	6.90
Zone C	1.15		81.5	11.4
Zone D		0.41	65.7	41.3
Zone E	0.27		64.6	47.4
Table No. 15-S (60 Mesh x 0)				
Zone A	0.06		65.8	39.6
Zone B	0.14		65.6	39.4
Zone C	0.19		65.8	40.2
Zone D	0.01		66.5	43.2
Zone E	0.01		66.2	48.0
Composite of Fractions	100.0		19.7	2.26
Analysis of Feed Coal			18.6	2.14

TABLE B-10

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Pyrite Beneficiation - Effects of Two-stage Cleaning

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

BCR Sample No. 2546

Pyrite Precleaning

Concentrating Table No. 14 Test   Run Date 4-9-70
Feed to Concentrating Table: Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	18.6	2.14
Zone E (Pyrite Zone)	2.6	74.1	20.5

Pyrite Cleaning

Concentrating Table No. 15-S Test   Run Date 4-24-70
Feed to Concentrating Table: Zone E, 3/8 Inch x 0 Run (4-9-70) Crushed to 30 Mesh x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	75.2	19.2
Zones D and E	26.4	64.6	47.4

Concentrating Table No. 15-S Test   Run Date
Feed to Concentrating Table: Process Deferred

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table			
Zone E (Pyrite Zone)			

Two Stage Pyrite Product	0.68	65.3	43.7

TABLE B-11

Flowsheet for Pyrite Beneficiation Tests

Upper Freeport Seam, Armstrong County, Pa.
BCR Sample No. 2546

Basis:
Pounds of Total Sulfur/Ton of
Run-of-Mine Coal

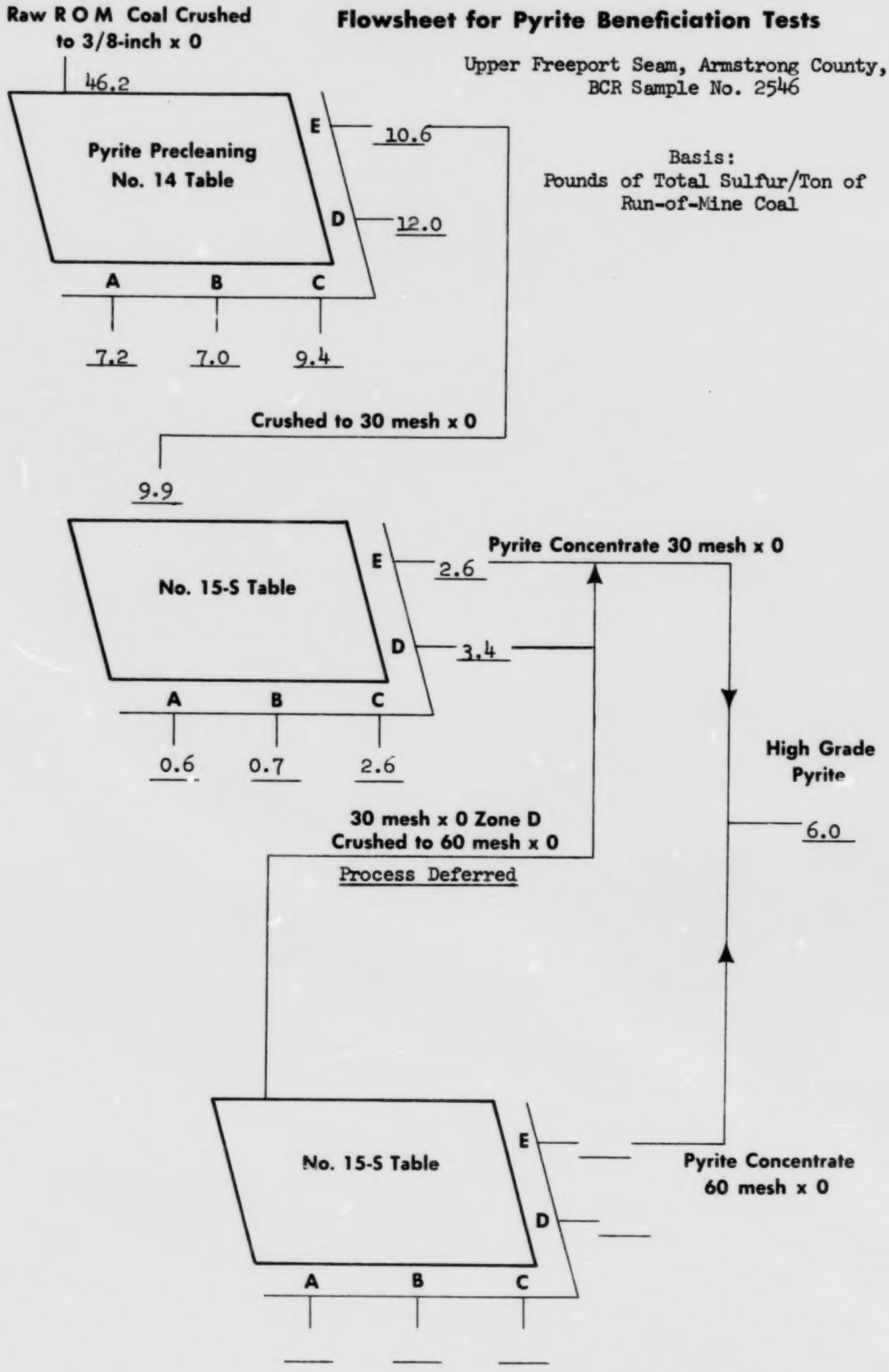

Raw R O M Coal Crushed
to 3/8-inch x 0
46.2
Pyrite Precleaning
No. 14 Table
E
10.6
D
12.0
A
B
C
7.2
7.0
9.4
Crushed to 30 mesh x 0
9.9
No. 15-S Table
E
2.6
Pyrite Concentrate 30 mesh x 0
D
3.4
A
B
C
0.6
0.7
2.6
High Grade
Pyrite
6.0
30 mesh x 0 Zone D
Crushed to 60 mesh x 0
Process Deferred
No. 15-S Table
E
Pyrite Concentrate
60 mesh x 0
D
A
B
C

TABLE B-12

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Flowsheet Data for Pyrite Beneficiation Tests

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

BCR Sample No. 2546

			Chemical Analysis, Dry Basis Weight Percent	
Fraction	Weight Percent		Ash	Total Sulfur
Table No. 14				
Zone A	38.6		5.99	0.92
Zone B	33.3		6.53	1.06
Zone C	13.7		30.0	3.41
Zone D	11.8		77.3	5.06
Zone E		2.6	74.1	20.5
Table No. 15-S (30 Mesh x 0)				
Zone A	0.26		68.8	13.0
Zone B	0.51		76.8	6.90
Zone C	1.15		81.5	11.4
Zone D	0.41		65.7	41.3
Zone E	0.27		64.6	47.4
Table No. 15-S (60 Mesh x 0)	Process Deferred			
Zone A				
Zone B				
Zone C				
Zone D				
Zone E				
Composite of Fractions	100.0		19.7	2.27
Analysis of Feed Coal			18.6	2.14

B-74.

A

TABLE B-13

Evaluation of Coal Cleaning Processes and Tec
for Removing Pyritic Sulfur from Fine Co

Concentrating Table Tests--3/8 Inch x 0 Rough C

Ash Characteristics

Coal Identification Upper Freeport Seam, Armstrong County, Pennsyl

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

B

Table Products	Product Weight Percent	Float and Sink Weight %	Chemical Analysis, Dry Basis, Weight Percent							Reducing Atmosph		
			Moisture	Ash	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Btu/lb	IDT	ST,S	ST,H
Zone A	38.6		0.80	5.99	0.92	0.01	0.37	0.54	14,478	2100	2460	
Zone B	33.3		0.64	6.53	1.06	--	0.54	0.52	14,366	2020	2470	
Zone C			0.60	30.2	3.38	0.01	2.87	0.50	10,362	2060	2560	
1.60 Float	7.4	54.3	0.68	13.1	2.30	0.02	1.73	0.55	13,222	2060	2460	
1.60 by 1.90	4.1	29.7	0.84	41.2	4.56	0.02	4.08	0.46	8,395	2460	2550	
1.90 Sink	2.2	16.0	0.76	66.3	5.04	0.02	4.79	0.23	4,146	2450	2580	
Composite	13.7	100.0		30.0	3.41	0.02	2.92	0.47	10,336			
Zone D			0.68	77.0	5.46	0.02	5.26	0.18	2,481	2150	2580	
1.90 Float	1.0	8.3	0.72	36.9	4.98	0.02	4.46	0.50	9,132	2170	2485	
1.90 by 2.95	10.4	88.0	0.77	81.8	3.64	0.01	3.49	0.14	1,781	2500	2620	
2.95 Sink	0.4	3.7	0.41	60.0	38.9	0.13	38.3	0.47	4,137	2340	2380	
Composite	11.8	100.0		77.3	5.06	0.02	4.86	0.18	2,478			
Zone E			0.30	75.2	19.2	0.06	18.8	0.34	2,339	2005	2095	
2.95 Float	1.5	58.5	0.64	82.6	5.54	0.02	5.41	0.11	1,648	2440	2560	
2.95 Sink	1.1	41.5	0.30	62.1	41.7	0.10	40.8	0.78	3,742	2370	2380	
Composite	2.6	100.0		74.1	20.5	0.06	20.1	0.39	2,517			
Composite of Table Products	100.0		1.50	19.6	2.31	0.01	1.82	0.48	12,146			
Analysis of Feed to Table				18.6	2.14	0.04	1.60	0.50	12,368	2040	2495	

Run Date: 4-9-70

IDT - Init
ST,S - Soft
ST,H - Soft
FT - Flu

B

TABLE B-13

al Cleaning Processes and Techniques
g Pyritic Sulfur from Fine Coal

e Tests--3/8 Inch x 0 Rough Cleaning

sh Characteristics

eam, Armstrong County, Pennsylvania

Coal Crushed to 3/8 Inch x 0

BCR Sample No. 2546

is,		Ash Fusibility								Ash Spectrography							
		Reducing Atmosphere				Oxidizing Atmosphere											
anic fur	Btu/lb	IDT	ST,S	ST,H	FT	IDT	ST,S	ST,H	FT	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	TiO_2	Na_2O	K_2O
.54	14,478	2100	2460		2750+	2610	2675		2750+	46.5	31.5	12.1	0.64	4.65	1.35	0.21	2.6
.52	14,366	2020	2470		2740	2585	2660		2750+	48.0	29.5	11.0	0.68	3.25	1.28	0.20	2.1
.50	10,362	2060	2560		2680	2625	2695		2750+	51.0	24.0	18.0	0.68	0.90	1.23	0.19	3.1
.55	13,222	2060	2460		2600	2540	2615		2745	46.0	28.0	17.5	0.55	2.10	1.20	0.18	2.5
.46	8,395	2460	2550		2705	2635	2700		2750+	54.0	25.0	15.0	1.04	0.69	1.50	0.19	3.4
.23	4,146	2450	2580		2750+	2560	2735		2750+	55.0	23.7	12.3	1.12	0.59	1.25	0.25	4.6
.47	10,336																
.18	2,481	2150	2580		2750+	2605	2740		2750+	55.0	24.5	11.5	0.81	0.46	1.22	0.26	4.3
.50	9,132	2170	2485		2680	2545	2660		2750+	50.0	24.0	17.4	0.96	0.79	1.24	0.22	3.7
.14	1,781	2500	2620		2750+	2745	2750+		2750+	57.0	24.5	8.6	1.18	0.45	1.24	0.30	6.0
.47	4,137	2340	2380		2480	2750+	2750+		2750+	8.5*	5.3*	85.0	0.26	0.54	0.20	0.03	0.2
.18	2,478																
.34	2,339	2005	2095		2380	2510	2570		2615	41.0	17.5	36.0	0.51	0.65	0.87	0.18	3.2
.11	1,648	2440	2560		2750+	2560	2750		2750+	54.5	24.3	11.5	1.15	0.51	1.14	0.29	5.7
.78	3,742	2370	2380		2410	2750+	2750+		2750+	7.8*	4.4*	85.0*	0.26	0.42	0.16	0.02	0.2
.39	2,517																
.48	12,146																
.50	12,368	2040	2495		2710	2620	2680		2750+	52.5	26.0	13.0	0.81	1.43	1.25	0.27	3.7

IDT - Initial Deformation Temperature
ST,S - Softening Temperature, Spherical
ST,H - Softening Temperature, Hemispherical
FT - Fluid Temperature

* Extrapolated Values

TABLE B-14

SCREEN ANALYSIS

Coal Identification Pittsburgh Seam, Monongalia County, West Virginia

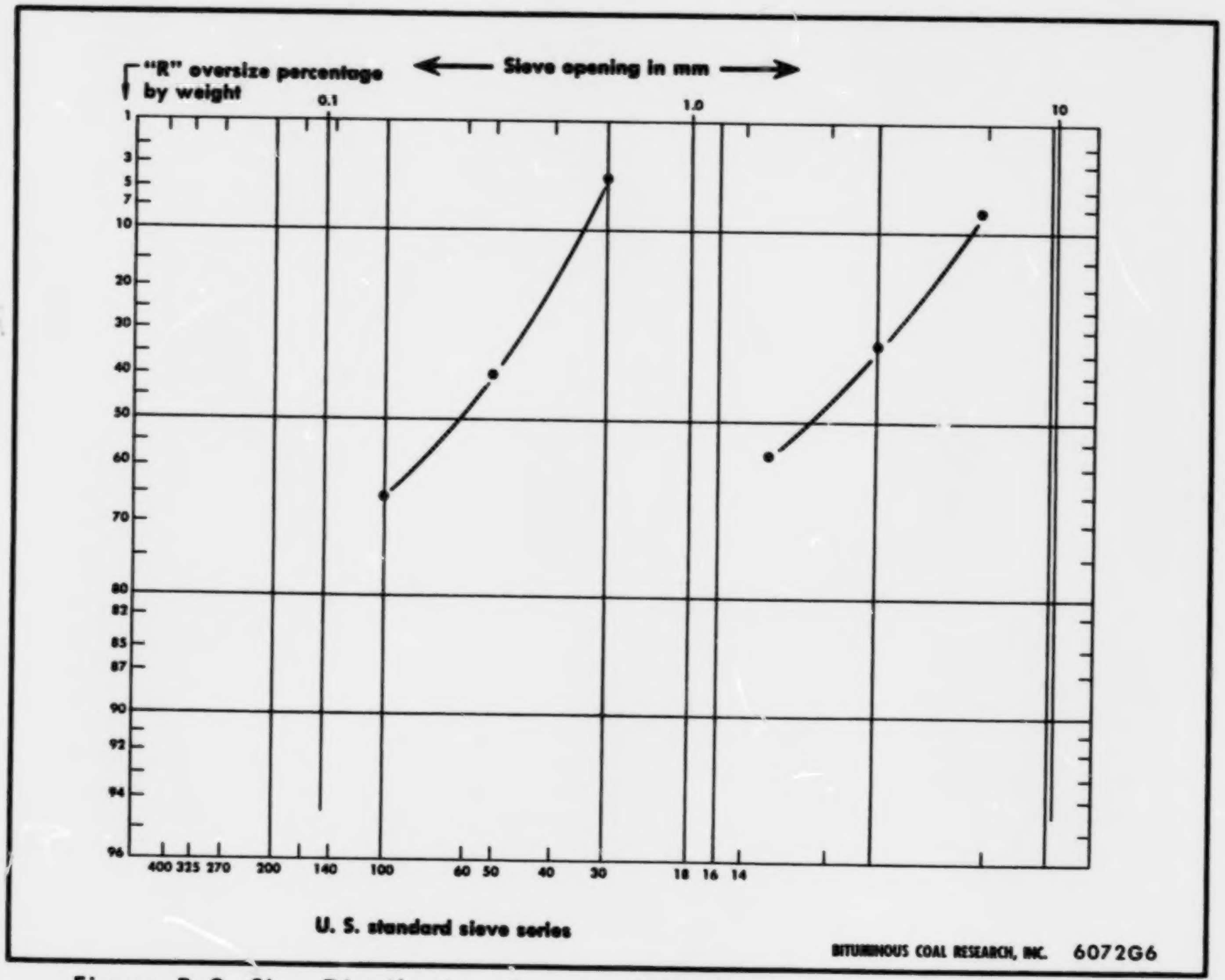
BCR Sample No. 2555

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

Screen Size	Weight Percent	Cumulative
plus 1/4 in.	7.7	7.7
1/4 in. x 6 M	25.3	33.0
6 M x 12 M	23.2	56.2
minus 12 M	43.8	100.0
Total	100.0	

Zones A, B and C from 3/8 Inch x 0 Run (5-13-70) Crushed to 30 Mesh x 0

Screen Size	Weight Percent	Cumulative
plus 30 M	4.3	4.3
30 M x 50 M	34.6	38.9
50 M x 100 M	25.9	64.8
minus 100 M	35.2	100.0
Total	100.0	



BITUMINOUS COAL RESEARCH, INC. 6072G6

Figure B-2. Size Distribution Curves of 30 Mesh X 0 and 3/8 Inch X 0 Concentrating Table Feeds for Pittsburgh Seam, Monongalia County, West Virginia, BCR Sample No. 2555

TABLE B-15

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--3/8 Inch x 0 Rough Cleaning and Pyrite Precleaning

Coal Identification Pittsburgh Seam, Monongalia County, West Virginia

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

BCR Sample No. 2555

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	51.8		1.02	6.04	1.84	
Zone B	38.8		0.96	6.52	2.06	
Zone C	2.2	53.3	0.96	18.4	3.54	
Float at 1.60	1.4	31.8	0.72	38.6	3.94	49.0
1.60 by 1.90	0.6	14.9	0.50	57.0	7.74	28.3
Sink at 1.90	4.2	100.0		30.6	4.29	
Composite						
Zone D						
Float at 1.90	0.6	15.8	0.74	36.0	3.50	49.0
1.90 by 2.95	2.8	76.4	0.83	73.2	5.34	14.9
Sink at 2.95	0.3	7.8	0.42	70.4	34.3	7.7
Composite	3.7	100.0		67.1	7.31	19.7
Zone E						
Float at 2.95	1.0	66.8	0.63	78.6	4.76	
Sink at 2.95	0.5	33.2	0.31	69.7	36.8	
Composite	1.5	100.0		75.6	15.4	
Composite of Zones A, B, C	94.8			7.32	2.04	
Composite of 1.60 Float Fractions	92.8			6.54	1.97	
Composite of 2.95 Sink Fractions	0.8			69.3	35.9	
Composite of Table Products	100.0			10.6	2.43	
Analysis of Feed to Table			1.08	10.5	2.52	

Run Date: 5-13-70

TABLE B-16

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--30 Mesh x 0 Deep Cleaning

Coal Identification Pittsburgh Seam, Monongalia County, West Virginia

Zones A, B, and C, 3/8 Inch x 0 Run (5-13-70) Crushed to 30 Mesh x 0

BCR Sample No. 2555

			Chemical Analysis, Dry Basis, Weight Percent			
Table Products	Product Weight Percent	Float and Sink Weight Percent	Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	78.5		0.96	6.02	1.86	
Zone B	16.4		0.82	6.73	1.92	
Zone C						
Float at 1.60	1.25	96.3	1.02	10.2	2.17	
Sink at 1.60	0.05	3.7	0.75	45.6	8.84	
Composite	1.30	100.0		11.5	2.42	
Zone D						
Float at 1.60	2.20	60.9	0.66	19.8	2.92	
1.60 by 2.95	1.36	38.0	0.81	44.9	6.23	
Sink at 2.95	0.04	1.1	0.44	64.4	35.0	
Composite	3.60	100.0		29.8	4.53	
Zone E						
Float at 2.95	0.12	58.0	0.63	65.0	14.8	
Sink at 2.95	0.08	42.0	0.52	62.4	42.0	
Composite	0.20	100.0		63.9	26.2	
Composite of Zones A, B, C	96.2			6.22	1.88	
Composite of 1.60 Float Fractions	98.3			6.47	1.90	
Composite of 2.95 Sink Fractions	0.12			63.1	39.7	
Composite of Table Products	100.0			7.18	2.02	
Analysis of Feed to Table			1.30	7.13	2.10	

Run Date: 5-26-70

TABLE B-17

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--Effects of Two-stage Cleaning

Coal Identification Pittsburgh Seam, Monongalia County, West Virginia

Composite of 3/8 Inch x 0 Run (5-13-70) and 30 Mesh x 0 Run (5-26-70)

BCR Sample No. 2555

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	74.4			6.02	1.86	
Zone B	15.6			6.73	1.92	
Zone C						
Float at 1.60	1.16	96.3		10.2	2.17	
Sink at 1.60	0.04	3.7		45.6	8.84	
Composite	1.20	100.0		11.5	2.42	
Zone D						
Float at 2.95	6.8	95.8		48.2	4.61	
Sink at 2.95	0.3	4.2		69.7	34.38	
Composite	7.1	100.0		49.1	5.86	
Zone E						
Float at 2.95	1.1	64.7		77.1	5.83	
Sink at 2.95	0.6	35.3		68.7	37.52	
Composite	1.7	100.0		74.1	17.02	
Composite of Zones A, B, C	91.2			6.21	1.88	
Composite of 1.60 Float Fractions	91.16			6.19	1.87	
Composite of 2.95 Sink Fractions	0.9			69.0	36.5	
Composite of Table Products	100.0			10.4	2.42	
Analysis of Feed to Table			1.08	10.5	2.52	

TABLE B-18

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table No. 15-S Tests - Pyrite Beneficiation

Coal Identification Pittsburgh Seam, Monongalia County, West Virginia

Zone E, 3/8 Inch x 0 Run (5-13-70) Crushed to 30 Mesh x 0

BCR Sample No. 2555

Table Products	Product, Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
		Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	2.5	0.69	71.0	11.3	
Zone B	9.9	0.62	73.0	10.2	
Zone C	9.4	0.52	71.6	10.4	
Zone D	70.5	0.38	78.0	11.0	7.8
Zone E	7.7	0.21	68.0	43.5	3.8
Composite of Table Products	100.0		76.0	13.4	
Analysis of Feed to Table		0.52	75.8	13.4	

Run Date: 6-4-70

TABLE B-19

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table No. 15-S Tests - Pyrite Beneficiation

Coal Identification Pittsburgh Seam, Monongalia County, West Virginia

Zone D, 30 Mesh x 0 Run (6-4-70) Crushed to 60 Mesh x 0

BCR Sample No. 2555

Table Products	Product, Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
		Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	1.7	0.56	78.1	8.16	
Zone B	20.0	0.49	78.4	8.20	
Zone C	24.4	0.60	78.6	7.66	
Zone D	44.9	0.37	76.6	9.26	6.8
Zone E	9.0	0.19	69.2	43.0	3.0
Composite of Table Products	100.0		76.8	11.7	
Analysis of Feed to Table		0.62	77.2	12.0	

Run Date: 6-23-70

TABLE B-20

Evaluation of Coal Cleaning Processes and Techniques
for Removing Pyritic Sulfur from Fine Coal

Pyrite Beneficiation - Effects of Two-stage Cleaning

Coal Identification Pittsburgh Seam, Monongalia County, West Virginia

BCR Sample No. 2555

Pyrite Precleaning

Concentrating Table No. 14 Test Run Date 5-13-70
Feed to Concentrating Table: Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight % Ash	Total Sulfur
Analysis of Feed to Table	100.0	10.5	2.52
Zone E (Pyrite Zone)	1.5	75.6	15.4

Pyrite Cleaning

Concentrating Table No. 15-S Test Run Date 6-4-70
Feed to Concentrating Table: Zone E, 3/8 Inch x 0 Run (5-13-70) Crushed to 30 Mesh x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight % Ash	Total Sulfur
Analysis of Feed to Table	100.0	75.8	13.4
Zone E (Pyrite Zone)	7.7	68.0	43.5

Concentrating Table No. 15-S Test Run Date 6-23-70
Feed to Concentrating Table: Zone D, 30 Mesh x 0 Run (6-4-70) Crushed to 60 Mesh x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight % Ash	Total Sulfur
Analysis of Feed to Table	100.0	77.2	12.0
Zone E (Pyrite Zone)	9.0	69.2	43.0

Two Stage Pyrite Product	0.20	68.5	43.3

TABLE B-21

Flowsheet for Pyrite Beneficiation Tests

Pittsburgh Seam, Monongalia County, W. Va.
BCR Sample No. 2555

Basis:
Pounds of Total Sulfur/Ton of
Run-of-Mine Coal

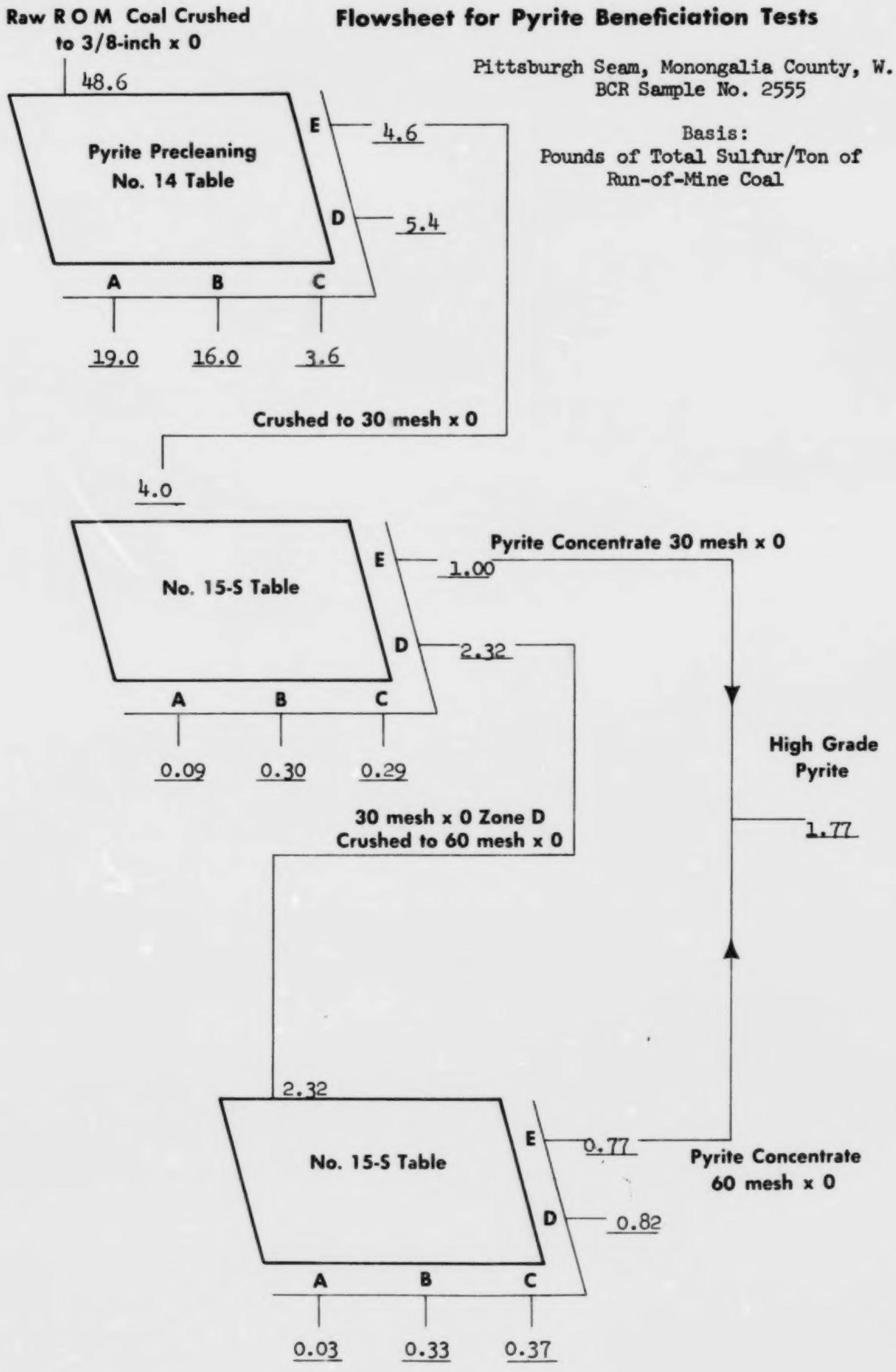

Raw R O M Coal Crushed to 3/8-inch x 0
48.6
Pyrite Precleaning No. 14 Table
E
4.6
D
5.4
A
B
C
19.0
16.0
3.6
Crushed to 30 mesh x 0
4.0
No. 15-S Table
E
1.00
Pyrite Concentrate 30 mesh x 0
D
2.32
A
B
C
0.09
0.30
0.29
High Grade Pyrite
1.77
30 mesh x 0 Zone D Crushed to 60 mesh x 0
2.32
No. 15-S Table
E
0.77
Pyrite Concentrate 60 mesh x 0
D
0.82
A
B
C
0.03
0.33
0.37

TABLE B-22

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Flowsheet Data for Pyrite Beneficiation Tests

Coal Identification Pittsburgh Seam, Monongalia County, West Virginia

BCR Sample No. 2555

Fraction	Weight Percent		Chemical Analysis, Dry Basis Weight Percent	
			Ash	Total Sulfur
Table No. 14				
Zone A	51.8		6.04	1.84
Zone B	38.8		6.52	2.06
Zone C	4.2		30.6	4.29
Zone D	3.7		67.1	7.31
Zone E		1.5	75.6	15.4
Table No. 15-S (30 Mesh x 0)				
Zone A	0.04		71.0	11.3
Zone B	0.15		73.0	10.2
Zone C	0.14		71.6	10.4
Zone D		1.06	78.0	11.0
Zone E	0.11		68.0	43.5
Table No. 15-S (60 Mesh x 0)				
Zone A	0.02		78.1	8.16
Zone B	0.21		78.4	8.20
Zone C	0.26		78.6	7.66
Zone D	0.48		76.6	9.26
Zone E	0.09		69.2	43.0
Composite of Fractions	100.0		10.6	2.41
Analysis of Feed Coal			10.5	2.52

A

TABLE B-23

Evaluation of Coal Cleaning Processes and Technic
for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--3/8 Inch x 0 Rough Clean

Ash Characteristics

Coal Identification Pittsburgh Seam, Monongalia County, West Virginia

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

BCR

			Chemical Analysis, Dry Basis, Weight Percent										Ash
										Reducing Atmosphere			
Table Products	Product Weight Percent	Float and Sink Weight %	Moisture	Ash	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Btu/lb	IDT	ST,S	ST,H	
Zone A	51.8		1.02	6.04	1.84	--	0.61	1.23	14,274	2460	2540		27
Zone B	38.8		0.96	6.52	2.06	--	0.80	1.26	14,158	2180	2380		26
Zone C			0.62	31.4	4.25	0.02	3.41	0.82	9,987	2040	2130		24
1.60 Float	2.2	53.3	0.96	18.4	3.54	--	2.42	1.12	12,242	2040	2140		26
1.60 by 1.90	1.4	31.8	0.72	38.6	3.94	0.01	3.31	0.62	8,702	2040	2140		23
1.90 Sink	0.6	14.9	0.50	57.0	7.74	0.06	7.38	0.30	4,126	2080	2140		21
Composite	4.2	100.0		30.6	4.29	0.01	3.44	0.84	9,907				
Zone D			0.49	68.0	7.09	0.04	6.76	0.29	3,596	2030	2140		24
1.90 Float	0.6	15.8	0.74	36.0	3.50	0.01	2.80	0.69	9,224	2040	2200		24
1.90 by 2.95	2.8	76.4	0.83	73.2	5.34	0.02	5.16	0.16	2,384	2050	2150		24
2.95 Sink	0.3	7.8	0.42	70.4	34.3	0.29	33.8	0.20	2,094	2350	2440		25
Composite	3.7	100.0		67.1	7.31	0.04	7.02	0.25	3,442				
Zone E			0.60	75.2	14.6	0.08	14.3	0.18	1,639	1920	2070		22
2.95 Float	1.0	66.8	0.63	78.6	4.76	0.04	4.64	0.08	961	2100	2140		23
2.95 Sink	0.5	33.2	0.31	69.7	36.8	0.31	36.2	0.33	2,114	2160	2270		23
Composite	1.5	100.0		75.6	15.4	0.13	15.1	0.16	1,344				
Composite of Table Products	100.0			10.6	2.43	0.00	1.26	1.17	13,451				
Analysis of Feed to Table			1.08	10.5	2.52	0.02	1.34	1.16	13,522	2140	2285		24

Run Date: 5-13-70

IDT - Initial
ST,S - Softeni
ST,H - Softeni
FT - Fluid T

B

TABLE B-23

Cleaning Processes and Techniques
yritic Sulfur from Fine Coal

ests--3/8 Inch x 0 Rough Cleaning

Characteristics

ngalia County, West Virginia

Crushed to 3/8 Inch x 0

BCR Sample No. 2555

	Ash Fusibility								Ash Spectrography							
	Reducing Atmosphere				Oxidizing Atmosphere											
Btu/lb	IDT	ST,S	ST,H	FT	IDT	ST,S	ST,H	FT	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	TiO_2	Na_2O	K_2O
14,274	2460	2540		2740	2580	2640		2750	47.0	25.9	10.0	0.85	4.3	1.29	0.75	1.9
14,158	2180	2380		2630	2475	2580		2730	47.0	24.1	12.2	0.91	4.5	1.15	0.58	1.9
9,987	2040	2130		2400	2160	2240		2460	41.0	13.6	12.9	1.73	13.4	0.83	0.26	1.4
12,242	2040	2140		2600	2435	2515		2690	52.5	21.5	17.5	0.85	3.4	1.19	0.45	2.6
8,702	2040	2140		2380	2180	2205		2520	43.5	14.3	11.6	2.35	13.0	0.96	0.38	1.3
4,126	2080	2140		2190	2180	2195		2205	28.0	9.1	16.7	2.60	24.0	0.71	0.21	0.7
9,907																
3,596	2030	2140		2450	2180	2210		2430	40.0	12.9	11.4	1.10	14.3	0.80	0.25	1.7
9,224	2040	2200		2430	2240	2340		2540	54.5	15.8	9.7	1.79	9.0	1.13	0.45	1.4
2,384	2050	2150		2430	2170	2215		2615	44.5	14.3	8.8	1.25	15.5	0.88	0.27	1.8
2,094	2350	2440		2500	2340	2360		2490	6.0*	2.5*	6.3*	1.42	14.6	0.13	0.03	0.1
3,442																
1,639	1920	2070		2215	2200	2225		2300	29.0	10.3	24.5	0.94	20.0	0.54	0.12	0.4
961	2100	2140		2300	2180	2200		2435	40.0	14.8	8.0	1.11	21.1	0.83	0.22	1.7
2,114	2160	2270		2310	2385	2750+		2750+	7.0*	2.5*	70.0*	1.32	12.6	0.15	0.03	0.1
1,344																
13,451																
13,522	2140	2285		2430	2350	2380		2540	44.0	18.9	12.9	0.94	9.0	1.03	0.45	1.6

IDT - Initial Deformation Temperature
ST,S - Softening Temperature, Spherical
ST,H - Softening Temperature, Hemispherical
FT - Fluid Temperature

*Extrapolated Values

TABLE B-24

SCREEN ANALYSIS

Coal Identification Ohio No. 9 Seam, Harrison County, Ohio

BCR Sample No. 2556

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

Screen Size	Weight Percent	Cumulative
plus 1/4 in.	8.3	8.3
1/4 in. x 6 M	31.7	40.0
6 M x 12 M	26.8	66.8
minus 12 M	33.2	100.0
Total	100.0	

Zones A, B and C from 3/8 Inch x 0 Run (6-12-70) Crushed to 30 Mesh x 0

Screen Size	Weight Percent	Cumulative
plus 30 M	10.5	10.5
30 M x 50 M	31.5	42.0
50 M x 100 M	22.6	64.6
minus 100 M	35.4	100.0
Total	100.0	

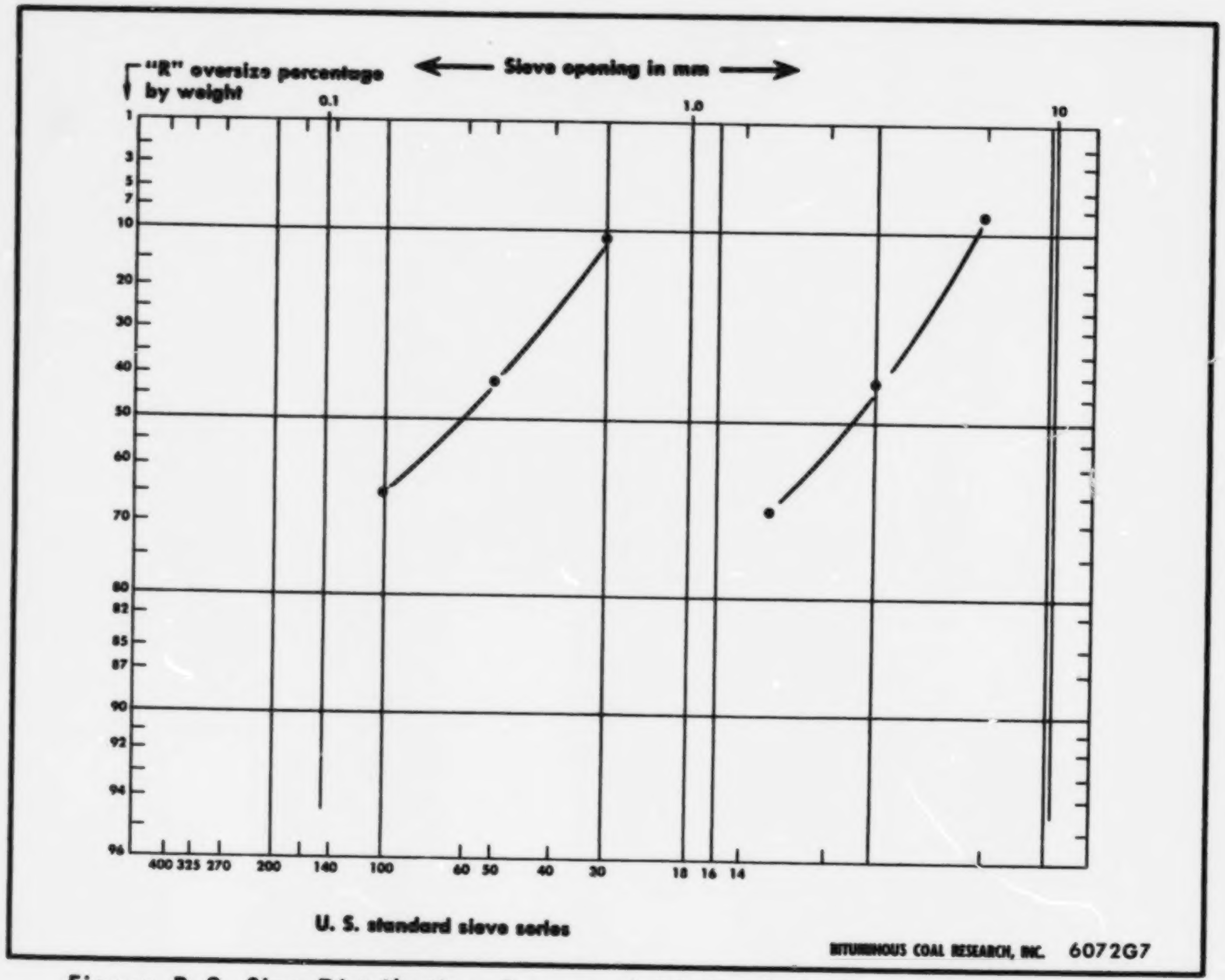


Figure B-3. Size Distribution Curves of 30 Mesh X 0 and 3/8 Inch X 0 Concentrating Table Feeds for Ohio No. 9 Seam, Harrison County, Ohio, BCR Sample No. 2556

TABLE B-25

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--3/8 Inch x 0 Rough Cleaning and Pyrite Precleaning

Coal Identification Ohio No. 9 Seam. Harrison County, Ohio

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

BCR Sample No. 2556

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	33.1		0.90	11.2	2.18	
Zone B	25.1		1.82	11.1	2.09	
Zone C						
Float at 1.60	29.1	88.2	1.12	11.7	2.30	
1.60 by 1.90	2.7	8.3	1.07	43.2	3.77	41.0
Sink at 1.90	1.2	3.5	1.04	61.8	6.31	24.3
Composite	33.0	100.0		16.1	2.56	
Zone D						
Float at 1.90	4.0	68.7	1.50	18.4	2.63	63.2
1.90 by 2.95	1.2	24.1	0.72	65.3	7.30	20.9
Sink at 2.95	0.4	7.2	0.50	60.4	43.4	8.5
Composite	5.8	100.0		32.7	6.69	49.1
Zone E						
Float at 2.95	2.2	72.5	0.91	38.9	5.41	
Sink at 2.95	0.8	27.5	0.40	60.8	44.6	
Composite	3.0	100.0		44.9	16.2	
Composite of Zones A, B, C	91.2			12.9	2.29	
Composite of 1.60 Float Fractions	87.3			11.3	2.19	
Composite of 2.95 Sink Fractions	1.2			60.7	44.2	
Composite of Table Products	100.0			15.0	2.96	
Analysis of Feed to Table			2.92	15.4	3.02	

Run Date: 6-12-70

TABLE B-26

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--30 Mesh x 0 Deep Cleaning

Coal Identification Ohio No. 9 Seam, Harrison County, Ohio

Zones A, B, and C, 3/8 Inch x 0 Run (6-11-70) Crushed to 30 Mesh x 0

BCR Sample No. 2556

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	76.6		1.65	11.1	1.87	
Zone B	14.7		1.44	12.4	1.96	
Zone C						
Float at 1.60	2.8	92.7	1.11	17.0	2.31	
Sink at 1.60	0.2	7.3	1.30	44.6	7.21	
Composite	3.0	100.0		19.0	2.67	
Zone D						
Float at 1.60	1.9	37.0	1.50	25.0	3.11	
1.60 by 2.95	3.1	60.7	1.06	48.3	5.78	
Sink at 2.95	0.1	2.3	1.18	61.4	41.6	
Composite	5.1	100.0		40.0	5.62	
Zone E						
Float at 2.95	0.25	41.8	0.80	63.2	13.1	
Sink at 2.95	0.35	58.2	0.61	62.0	42.7	
Composite	0.6	100.0		62.5	30.4	
Composite of Zones A, B, C	94.3			11.5	1.91	
Composite of 1.60 Float Fractions	96.0			11.7	1.92	
Composite of 2.95 Sink Fractions	0.45			61.9	42.5	
Composite of Table Products	100.0			13.3	2.27	
Analysis of Feed to Table			1.56	13.2	2.36	

Run Date: 7-10-70

TABLE B-27

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--Effects of Two-stage Cleaning

Coal Identification Ohio No. 9 Seam, Harrison County, Ohio

Composite of 3/8 Inch x 0 Run (6-12-70) and 30 Mesh x 0 Run (7-10-70)

BCR Sample No. 2556

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	69.9			11.1	1.87	
Zone B	13.4			12.4	1.96	
Zone C						
Float at 1.60	2.5	92.7		17.0	2.31	
Sink at 1.60	0.2	7.3		44.6	7.21	
Composite	2.7	100.0		19.0	2.67	
Zone D						
Float at 2.95	10.0	95.2		34.7	4.27	
Sink at 2.95	0.5	4.8		60.6	43.0	
Composite	10.5	100.0		35.9	6.13	
Zone E						
Float at 2.95	2.4	68.6		40.9	6.05	
Sink at 2.95	1.1	31.4		61.1	44.1	
Composite	3.5	100.0		47.2	18.0	
Composite of Zones A, B, C	86.0			11.5	1.91	
Composite of 1.60 Float Fractions	85.8			11.5	1.90	
Composite of 2.95 Sink Fractions	1.6			60.9	43.8	
Composite of Table Products	100.0			15.4	2.92	
Analysis of Feed to Table			2.92	15.4	3.02	

TABLE B-28

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table No. 15-S Tests - Pyrite Beneficiation

Coal Identification Ohio No. 9 Seam, Harrison County, Ohio

Zone E, 3/8 Inch x 0 Run (6-12-70) Crushed to 30 Mesh x 0

BCR Sample No. 2556

Table Products	Product, Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
		Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	7.7	1.09	41.2	19.2	
Zone B	15.8	1.14	36.6	14.7	
Zone C	12.9	1.26	33.5	8.14	
Zone D	24.8	0.90	66.6	15.4	16.3
Zone E	38.8	0.32	63.0	44.1	5.4
Composite of Table Products	100.0		54.2	25.8	
Analysis of Feed to Table		0.60	53.8	25.2	

Run Date: 7-17-70

TABLE B-29

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table No. 15-S Tests - Pyrite Beneficiation

Coal Identification Ohio No. 9 Seam, Harrison County, Ohio

Zone D, 30 Mesh x 0 Run (7-17-70) Crushed to 60 Mesh x 0

BCR Sample No. 2556

Table Products	Product, Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
		Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	3.0	0.88	63.8	13.0	
Zone B	22.8	0.80	64.5	12.4	
Zone C	34.8	0.79	64.6	11.2	
Zone D	28.1	0.62	68.6	11.4	15.5
Zone E	11.3	0.28	66.2	43.5	3.5
Composite of Table Products	100.0		65.9	15.2	
Analysis of Feed to Table		0.70	66.4	16.0	

Run Date: 8-11-70

TABLE B-30

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Pyrite Beneficiation - Effects of Two-stage Cleaning

Coal Identification Ohio No. 9 Seam, Harrison County, Ohio

BCR Sample No. 2556

Pyrite Precleaning

Concentrating Table No. 14 Test Run Date 6-12-70

Feed to Concentrating Table: Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	15.4	3.02
Zone E (Pyrite Zone)	3.0	44.9	16.2

Pyrite Cleaning

Concentrating Table No. 15-S Test Run Date 7-17-70

Feed to Concentrating Table: Zone E, 3/8 Inch x 0 Run (6-12-70) Crushed to 30 Mesh x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	53.8	25.2
Zone E (Pyrite Zone)	38.8	63.0	44.1

Concentrating Table No. 15-S Test Run Date 8-11-70

Feed to Concentrating Table: Zone D, 30 Mesh x 0 Run (7-17-70) Crushed to 60 Mesh x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	66.4	16.0
Zone E (Pyrite Zone)	11.3	66.2	43.5

Two Stage Pyrite Product	1.25	63.2	44.1

TABLE B-31

Flowsheet for Pyrite Beneficiation Tests

Ohio No. 9 Seam, Harrison County, Ohio
BCR Sample No. 2556
Basis:
Pounds of Total Sulfur/Ton of
Run-of-Mine Coal

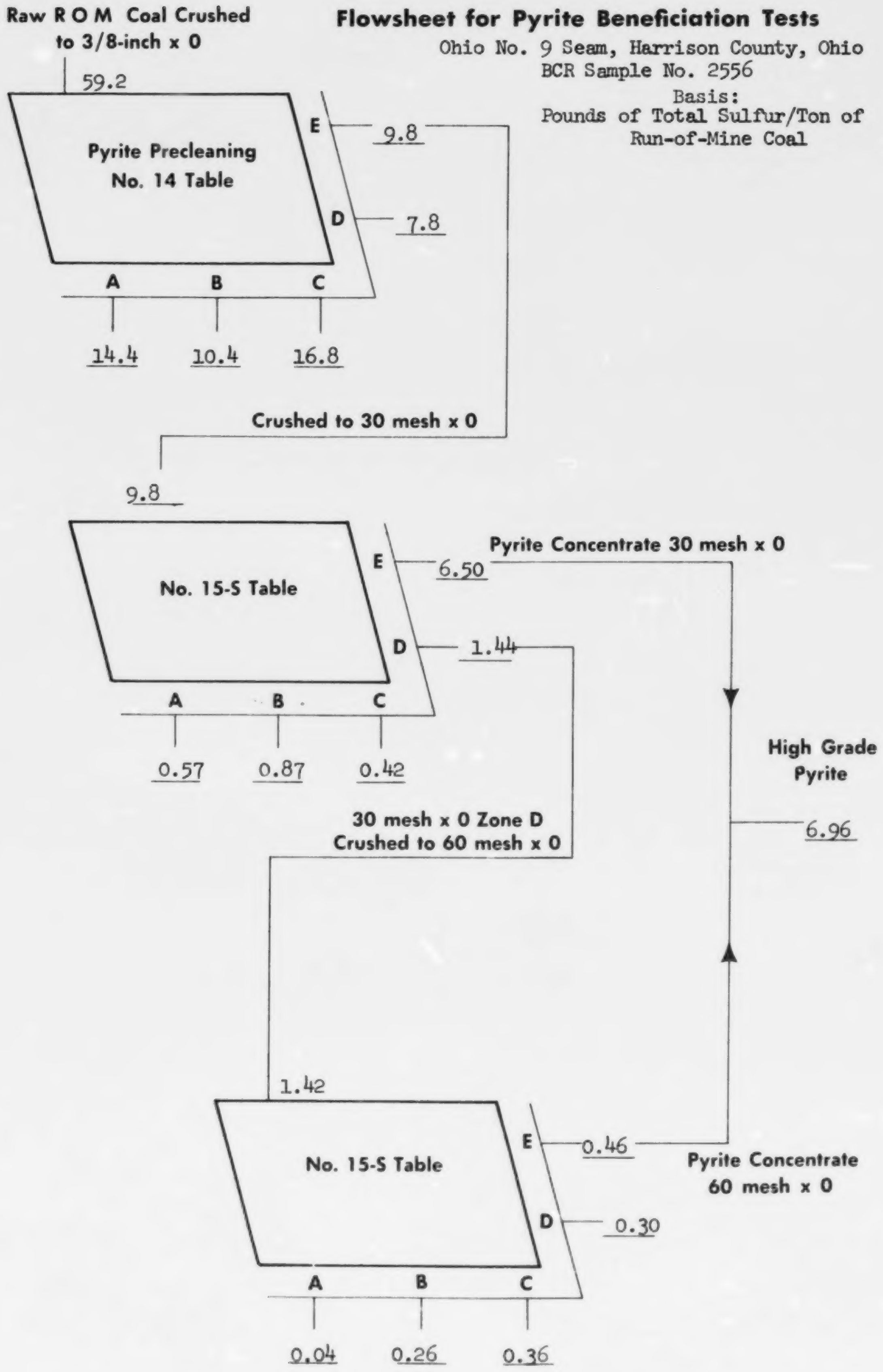

Raw R O M Coal Crushed to 3/8-inch x 0
59.2
Pyrite Precleaning No. 14 Table
E
9.8
D
7.8
A
B
C
14.4
10.4
16.8
Crushed to 30 mesh x 0
9.8
No. 15-S Table
E
6.50
Pyrite Concentrate 30 mesh x 0
D
1.44
A
B
C
0.57
0.87
0.42
High Grade Pyrite
6.96
30 mesh x 0 Zone D Crushed to 60 mesh x 0
1.42
No. 15-S Table
E
0.46
Pyrite Concentrate 60 mesh x 0
D
0.30
A
B
C
0.04
0.26
0.36

TABLE B-32

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Flowsheet Data for Pyrite Beneficiation Tests

Coal Identification Ohio No. 9 Seam, Harrison County, Ohio

BCR Sample No. 2556

Fraction	Weight Percent		Chemical Analysis, Dry Basis Weight Percent	
			Ash	Total Sulfur
Table No. 14				
Zone A	33.1		11.2	2.18
Zone B	25.1		11.1	2.09
Zone C	33.0		16.1	2.56
Zone D	5.8		32.7	6.69
Zone E		3.0	44.9	16.2
Table No. 15-S (30 Mesh x 0)				
Zone A	0.23		41.2	19.2
Zone B	0.47		36.6	14.7
Zone C	0.39		33.5	8.14
Zone D		0.75	66.6	15.4
Zone E	1.16		63.0	44.1
Table No. 15-S (60 Mesh x 0)				
Zone A	0.02		63.8	13.0
Zone B	0.17		64.5	12.4
Zone C	0.26		64.6	11.2
Zone D	0.21		68.6	11.4
Zone E	0.09		66.2	43.5
Composite of Fractions	100.0		15.3	3.25
Analysis of Feed Coal		2.92	15.4	3.02

A

TABLE B-33

Evaluation of Coal Cleaning Processes and Techniq
for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--3/8 Inch x 0 Rough Clean

Ash Characteristics

Coal Identification Ohio No. 9 Seam, Harrison County, Ohio

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

BCR S

			Chemical Analysis, Dry Basis, Weight Percent							Ash			
										Reducing Atmosphere			
Table Products	Product Weight Percent	Float and Sink Weight %	Moisture	Ash	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Btu/lb	IDT	ST,S	ST,H	F
Zone A	33.1		0.90	11.2	2.18	--	1.54	0.64	12,898	2510	2560		2750
Zone B	25.1		1.82	11.1	2.09	--	1.43	0.66	12,966	2500	2595		2715
Zone C			1.32	16.2	2.66	0.01	2.03	0.62	12,102	2425	2535		2650
1.60 Float	29.1	88.2	1.12	11.7	2.30	--	1.64	0.66	12,801	2480	2560		2710
1.60 by 1.90	2.7	8.3	1.07	43.2	3.77	0.03	3.38	0.36	7,648	2425	2550		2750
1.90 Sink	1.2	3.5	1.04	61.8	6.31	0.09	6.00	0.22	4,563	2140	2320		2730
Composite	33.0	100.0		16.1	2.56	0.01	1.94	0.62	12,085				
Zone D			0.92	33.1	6.36	0.05	5.81	0.50	9,340	2000	2170		2340
1.90 Float	4.0	68.7	1.50	18.4	2.63	0.02	2.02	0.59	11,740	2395	2515		2720
1.90 by 2.95	1.4	24.1	0.72	65.3	7.30	0.10	7.02	0.18	4,011	2080	2190		2615
2.95 Sink	0.4	7.2	0.50	60.4	43.4	0.50	42.6	0.34	2,964	2435	2440		2445
Composite	5.8	100.0		32.7	6.69	0.07	6.15	0.47	9,245				
Zone E			0.48	45.8	16.2	0.11	15.7	0.36	7,041	1970	2000		2220
2.95 Float	2.2	72.5	0.91	38.9	5.41	0.07	4.92	0.42	8,360	2090	2180		2630
2.95 Sink	0.8	27.5	0.40	60.8	44.6	0.52	43.8	0.32	2,964	2430	2435		2440
Composite	3.0	100.0		44.9	16.2	0.19	15.6	0.39	6,876				
Composite of Table Products	100.0			15.0	2.96	0.01	2.33	0.62	12,254				
Analysis of Feed to Table			2.92	15.4	3.02	0.06	2.34	0.62	12,238	2120	2400		2510

Run Date: 6-11-70

IDT - Initial
ST,S - Softenin
ST,H - Softenin
FT - Fluid Te

B

TABLE B-33

l Cleaning Processes and Techniques
Pyritic Sulfur from Fine Coal

Tests--3/8 Inch x 0 Rough Cleaning

h Characteristics

arrison County, Ohio

al Crushed to 3/8 Inch x 0

BCR Sample No. 2556

,		Ash Fusibility								Ash Spectrography							
ic		Reducing Atmosphere				Oxidizing Atmosphere											
r	Btu/lb	IDT	ST,S	ST,H	FT	IDT	ST,S	ST,H	FT	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	TiO_2	Na_2O	K_2O
4	12,898	2510	2560		2750+	2620	2700		2750+	54.0	25.0	14.1	0.64	0.70	1.22	0.28	3.6
6	12,966	2500	2595		2715	2640	2710		2750+	54.0	24.5	13.0	0.68	0.70	1.23	0.30	4.2
2	12,102	2425	2535		2650	2560	2670		2750+	54.0	24.0	13.2	0.71	0.56	1.15	0.29	4.0
6	12,801	2480	2560		2710	2635	2700		2750+	56.0	24.5	13.5	0.57	0.60	1.10	0.25	2.9
6	7,648	2425	2550		2750+	2545	2700		2750+	60.0	23.5	11.8	1.11	0.30	1.18	0.21	3.0
2	4,563	2140	2320		2730	2490	2565		2740	57.0	20.0	15.5	1.16	0.51	1.06	0.19	3.3
2	12,085																
0	9,340	2000	2170		2340	2470	2540		2620	50.0	19.4	22.6	0.91	1.05	0.90	0.24	4.1
9	11,740	2395	2515		2720	2580	2690		2750+	56.0	23.3	14.2	0.85	0.56	1.16	0.24	2.8
8	4,011	2080	2190		2615	2420	2520		2745	56.0	20.7	16.3	1.27	1.65	0.93	0.22	3.6
4	2,964	2435	2440		2445	2750+	2750+		2750+	7.6*	1.3*	90.0*	<0.3	0.59	0.08	<0.02	<0.1
7	9,245																
6	7,041	1970	2000		2220	2475	2580		2600	34.5	13.4	47.0	0.71	1.02	0.61	0.12	1.6
2	8,360	2090	2180		2630	2490	2555		2700	54.0	21.0	17.0	1.10	1.25	0.98	0.20	4.0
2	2,964	2430	2435		2440	2750+	2750+		2750+	6.3*	1.3*	90.0*	<0.3	0.31	0.07	<0.02	<0.1
9	6,876																
2	12,254																
2	12,238	2120	2400		2510	2520	2600		2750	53.0	22.0	18.7	0.77	0.74	1.10	0.24	2.9

IDT - Initial Deformation Temperature
ST,S - Softening Temperature, Spherical
ST,H - Softening Temperature, Hemispherical
FT - Fluid Temperature

* Extrapolated Values

TABLE B-34

SCREEN ANALYSIS

Coal Identification Ohio No. 8 Seam, Jefferson County, Ohio

BCR Sample No. 2574

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

Screen Size	Weight Percent	Cumulative
plus 1/4 in.	10.8	10.8
1/4 in. x 6 M	31.6	42.4
6 M x 12 M	22.1	64.5
minus 12 M	35.5	100.0
Total	100.0	

Zones A, B and C from 3/8 Inch x 0 Run (7-14-70) Crushed to 30 Mesh x 0

Screen Size	Weight Percent	Cumulative
plus 30 M	5.0	5.0
30 M x 50 M	29.0	34.0
50 M x 100 M	25.4	59.4
minus 100 M	40.6	100.0
Total	100.0	

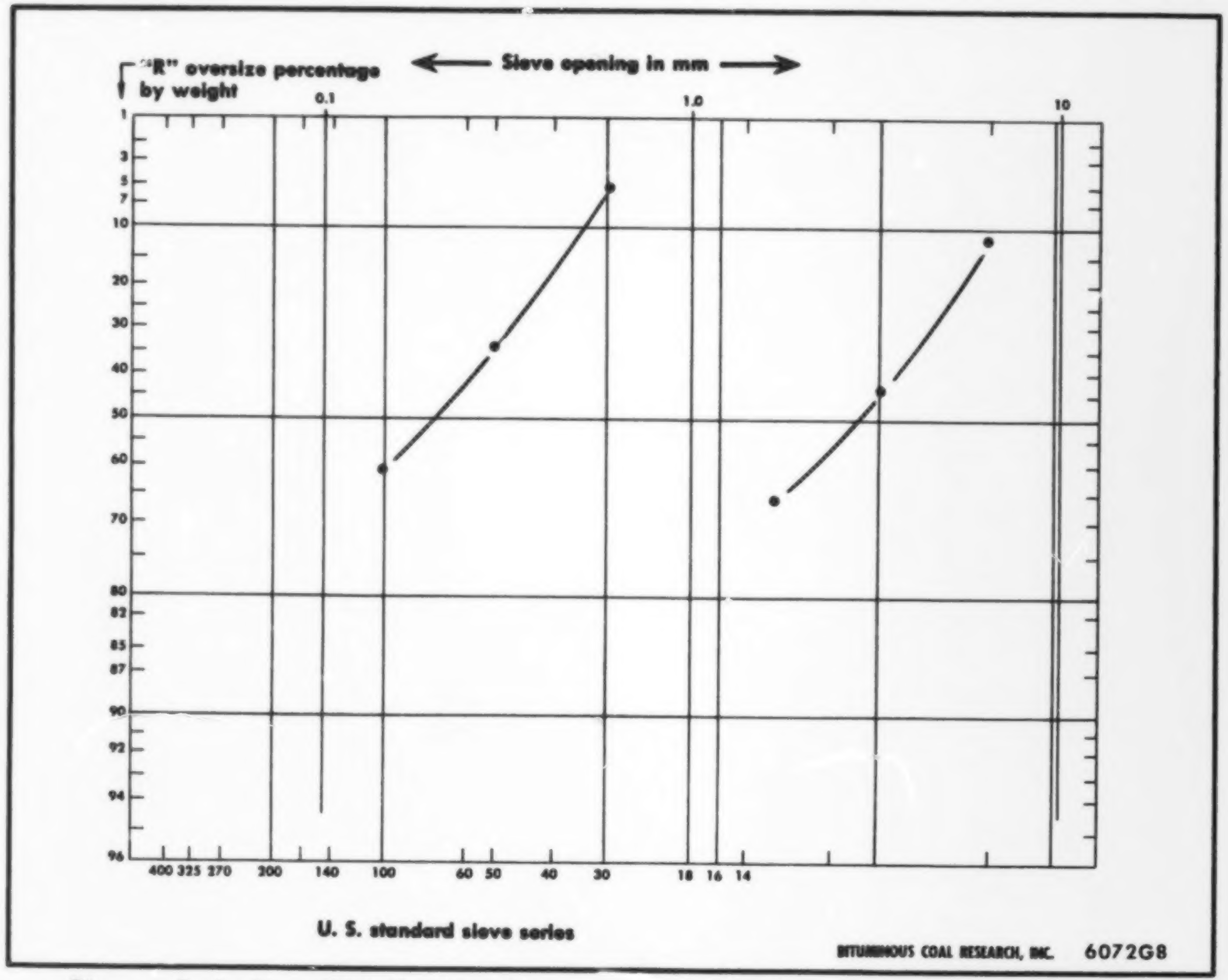


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Figure B-4. Size Distribution Curves of 30 Mesh X 0 and 3/8 Inch X 0 Concentrating Table Feeds for Ohio No. 8 Seam, Jefferson County, Ohio, BCR Sample No. 2574

TABLE B-35

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--3/8 Inch x 0 Rough Cleaning and Pyrite Precleaning

Coal Identification Ohio No. 8 Seam. Jefferson County, Ohio

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

BCR Sample No. 2574

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	40.9		1.11	6.90	2.66	
Zone B	41.2		1.66	6.50	2.74	
Zone C						
Float at 1.60	8.8	80.3	0.86	8.52	3.54	
1.60 by 1.90	1.6	14.4	0.66	34.3	8.80	47.5
Sink at 1.90	0.6	5.3	1.02	57.9	14.1	24.2
Composite	11.0	100.0		14.8	4.86	
Zone D						
Float at 1.90	0.5	12.3	1.12	33.2	8.58	45.8
1.90 by 2.95	2.8	75.5	1.06	73.7	7.33	13.2
Sink at 2.95	0.4	12.2	1.22	59.4	44.0	8.0
Composite	3.7	100.0		67.0	12.0	16.6
Zone E						
Float at 2.95	1.5	47.5	0.55	80.4	6.58	
Sink at 2.95	1.7	52.5	0.84	60.6	44.4	
Composite	3.2	100.0		70.0	26.4	
Composite of Zones A, B, C	93.1			7.66	2.96	
Composite of 1.60 Float Fractions	90.9			6.88	2.78	
Composite of 2.95 Sink Fractions	2.1			60.4	44.3	
Composite of Table Products	100.0			11.8	4.04	
Analysis of Feed to Table			2.47	10.9	3.81	

Run Date: 7-14-70

TABLE B-36

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--30 Mesh x 0 Deep Cleaning

Coal Identification Ohio No. 8 Seam, Jefferson County, Ohio

Zones A, B, and C, 3/8 Inch x 0 Run (7-14-70) Crushed to 30 Mesh x 0

BCR Sample No. 2574

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	78.1		1.22	6.13	2.46	
Zone B	15.9		1.00	6.22	2.50	
Zone C						
Float at 1.60	1.17	97.5	1.16	7.48	2.88	
Sink at 1.60	0.03	2.5	0.87	40.2	15.2	
Composite	1.2	100.0		8.30	3.19	
Zone D						
Float at 1.60	3.21	78.4	0.72	14.4	4.86	
1.60 by 2.95	0.87	21.1	1.15	39.6	10.8	
Sink at 2.95	0.02	0.5	0.52	61.6	43.1	
Composite	4.1	100.0		20.0	6.30	
Zone E						
Float at 2.95	0.43	61.1	0.72	52.7	15.8	
Sink at 2.95	0.27	38.9	0.12	61.9	45.0	
Composite	0.7	100.0		56.3	27.2	
Composite of Zones A, B, C	95.2			6.17	2.48	
Composite of 1.60 Float Fractions	98.4			6.43	2.55	
Composite of 2.95 Sink Fractions	0.29			61.9	44.9	
Composite of Table Products	100.0			7.09	2.81	
Analysis of Feed to Table			1.40	7.18	2.92	

Run Date: 7-30-70

TABLE B-37

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--Effects of Two-stage Cleaning

Coal Identification Ohio No. 8 Seam, Jefferson County, Ohio

Composite of 3/8 Inch x 0 Run (7-14-70) and 30 Mesh x 0 Run (7-30-70)

BCR Sample No. 2574

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	72.7			6.13	2.46	
Zone B	14.8			6.22	2.50	
Zone C						
Float at 1.60	1.07	97.5		7.48	2.88	
Sink at 1.60	0.03	2.5		40.2	15.2	
Composite	1.1	100.0		8.30	3.19	
Zone D						
Float at 2.95	7.1	94.4		42.3	6.77	
Sink at 2.95	0.4	5.6		59.5	4.40	
Composite	7.5	100.0		43.3	8.85	
Zone E						
Float at 2.95	1.9	49.5		74.2	8.64	
Sink at 2.95	2.0	50.5		60.8	44.5	
Composite	3.9	100.0		67.4	26.7	
Composite of Zones A, B, C	88.6			6.17	2.48	
Composite of 1.60 Float Fractions	88.57			6.16	2.47	
Composite of 2.95 Sink Fractions	2.4			60.6	44.4	
Composite of Table Products	100.0			11.3	3.90	
Analysis of Feed to Table			2.47	10.9	3.81	

TABLE B-38

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table No. 15-S Tests - Pyrite Beneficiation

Coal Identification Ohio No. 8 Seam, Jefferson County, Ohio

Zone E, 3/8 Inch x 0 Run (7-14-70) Crushed to 30 Mesh x 0

BCR Sample No. 2574

Table Products	Product, Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
		Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	3.2	0.82	70.8	13.8	
Zone B	11.0	0.90	71.6	12.8	
Zone C	9.2	1.10	70.6	14.0	
Zone D	48.7	0.62	77.1	15.1	7.2
Zone E	27.9	0.28	63.2	45.2	4.4
Composite of Table Products	100.0		71.8	23.1	
Analysis of Feed to Table		1.12	71.2	22.4	

Run Date: 8-6-70

TABLE B-39

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table No. 15-S Tests - Pyrite Beneficiation

Coal Identification Ohio No. 8 Seam, Jefferson County, Ohio

Zone D, 30 Mesh x 0 Run (8-6-70) Crushed to 60 Mesh x 0

BCR Sample No. 2574

Table Products	Product, Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
		Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	2.9	1.05	73.4	16.6	
Zone B	24.9	0.96	73.9	16.9	
Zone C	36.0	0.88	74.4	16.3	
Zone D	23.0	0.56	78.0	18.6	5.3
Zone E	13.2	0.30	65.4	44.4	4.3
Composite of Table Products	100.0		73.9	20.7	
Analysis of Feed to Table		1.71	73.6	20.0	

Run Date: 9-2-70

TABLE B-40

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Pyrite Beneficiation - Effects of Two-stage Cleaning

Coal Identification Ohio No. 8 Seam, Jefferson County, Ohio

BCR Sample No. 2574

Pyrite Precleaning

Concentrating Table No. 14 Test Run Date 7-14-70

Feed to Concentrating Table: Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight % Ash	Total Sulfur
Analysis of Feed to Table	100.0	10.9	3.81
Zone E (Pyrite Zone)	3.2	70.0	26.4

Pyrite Cleaning

Concentrating Table No. 15-S Test Run Date 8-6-70

Feed to Concentrating Table: Zone E, 3/8 Inch x 0 Run (7-14-70) Crushed to 30 Mesh x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight % Ash	Total Sulfur
Analysis of Feed to Table	100.0	71.2	22.4
Zone E (Pyrite Zone)	27.9	63.2	45.2

Concentrating Table No. 15-S Test Run Date 9-2-70

Feed to Concentrating Table: Zone D, 30 Mesh x 0 Run (8-6-70) Crushed to 60 Mesh x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight % Ash	Total Sulfur
Analysis of Feed to Table	100.0	73.6	20.0
Zone E (Pyrite Zone)	13.2	65.4	44.4

Two Stage Pyrite Product	1.11	63.6	45.0

TABLE B-41

Flowsheet for Pyrite Beneficiation Tests

Ohio No. 8 Seam, Jefferson County, Ohio
BCR Sample No. 2574
Basis:
Pounds of Total Sulfur/Ton of
Run-of-Mine Coal

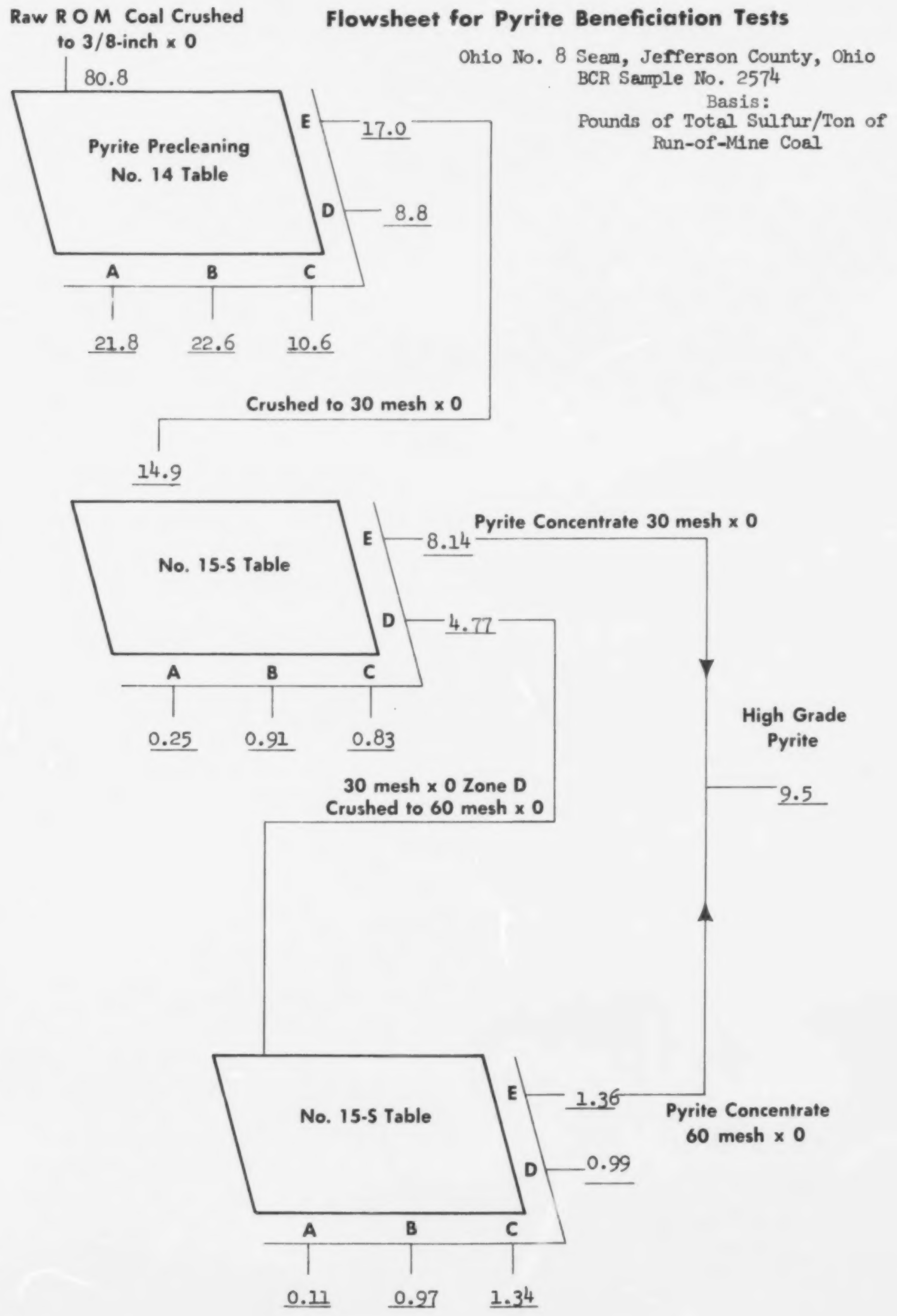
Raw R O M Coal Crushed to 3/8-inch x 0
80.8
Pyrite Precleaning No. 14 Table
E
17.0
D
8.8
A
B
C
21.8
22.6
10.6
Crushed to 30 mesh x 0
14.9
No. 15-S Table
E
8.14
Pyrite Concentrate 30 mesh x 0
D
4.77
A
B
C
0.25
0.91
0.83
High Grade Pyrite
9.5
30 mesh x 0 Zone D Crushed to 60 mesh x 0
No. 15-S Table
E
1.36
Pyrite Concentrate 60 mesh x 0
D
0.99
A
B
C
0.11
0.97
1.34

TABLE B-42

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Flowsheet Data for Pyrite Beneficiation Tests

Coal Identification Ohio No. 8 Seam, Jefferson County, Ohio

BCR Sample No. 2574

Fraction	Weight Percent		Chemical Analysis, Dry Basis Weight Percent	
			Ash	Total Sulfur
Table No. 14				
Zone A	40.9		6.90	2.66
Zone B	41.2		6.50	2.74
Zone C	11.0		14.8	4.86
Zone D	3.7		67.0	12.0
Zone E		3.2	70.0	26.4
Table No. 15-S (30 Mesh x 0)				
Zone A	0.10		70.8	13.8
Zone B	0.35		71.6	12.8
Zone C	0.29		70.6	14.0
Zone D		1.56	77.1	15.1
Zone E	0.90		63.2	45.2
Table No. 15-S (60 Mesh x 0)				
Zone A	0.04		73.4	16.6
Zone B	0.39		73.9	16.9
Zone C	0.56		74.4	16.3
Zone D	0.36		78.0	18.6
Zone E	0.21		65.4	44.4
Composite of Fractions	100.0		11.9	4.03
Analysis of Feed Coal			10.9	3.81

A

TABLE B-43

Evaluation of Coal Cleaning Processes and Technique
for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--3/8 Inch x 0 Rough Cleanin

Ash Characteristics

Coal Identification Ohio No. 8 Seam, Jefferson County, Ohio

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

BCR Sa

Table Products	Product Weight Percent	Float and Sink Weight %	Chemical Analysis, Dry Basis, Weight Percent							Ash F			
										Reducing Atmosphere			
			Moisture	Ash	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Btu/lb	IDT	ST,S	ST,H	FT
Zone A	40.9		1.11	6.90	2.66	0.04	1.81	0.81	13,686	1980	2100		2520
Zone B	41.2		1.66	6.50	2.74	0.04	1.88	0.82	13,756	1945	2050		2500
Zone C			0.74	15.0	4.76	0.05	3.95	0.76	12,281	2000	2085		2460
1.60 Float	8.8	80.3	0.86	8.52	3.54	0.03	2.65	0.86	13,396	1940	2020		2420
1.60 by 1.90	1.6	14.4	0.66	34.3	8.80	0.08	8.21	0.51	8,943	2040	2115		2420
1.90 Sink	0.6	5.3	1.02	57.9	14.1	0.18	13.6	0.28	4,875	1980	2020		2480
Composite	11.0	100.0		14.8	4.86	0.05	4.03	0.78	12,303				
Zone D			0.72	67.6	11.3	0.12	11.0	0.20	3,649	2050	2130		2630
1.90 Float	0.5	12.3	1.12	33.2	8.58	0.08	7.98	0.52	9,172	2000	2090		2480
1.90 by 2.95	2.8	75.5	1.06	73.7	7.33	0.11	7.08	0.14	2,646	2180	2430		2615
2.95 Sink	0.4	12.2	1.22	59.4	44.0	0.44	43.3	0.25	2,784	2440	2450		2460
Composite	3.7	100.0		67.0	12.0	0.15	11.6	0.20	3,466				
Zone E			0.40	70.7	26.4	0.21	26.0	0.23	3,175	1960	1980		2200
2.95 Float	1.5	47.5	0.55	80.4	6.58	0.16	6.32	0.10	1,560	2135	2380		2700
2.95 Sink	1.7	52.5	0.84	60.6	44.4	0.50	43.6	0.35	2,868	2450	2455		2460
Composite	3.2	100.0		70.0	26.4	0.34	25.9	0.23	2,247				
Composite of Table Products	100.0			11.8	4.04	0.05	3.22	0.77	12,819				
Analysis of Feed to Table			2.47	10.9	3.81	0.12	2.93	0.76	12,998	1940	1990		2360

Run Date: 7-14-70

IDT - Initial D
ST,S - Softening
ST,H - Softening
FT - Fluid Tem

TABLE B-43

B

Coal Cleaning Processes and Techniques
ging Pyritic Sulfur from Fine Coal

ble Tests--3/8 Inch x 0 Rough Cleaning

Ash Characteristics

m, Jefferson County, Ohio

e Coal Crushed to 3/8 Inch x 0

BCR Sample No. 2574

sis,		Ash Fusibility								Ash Spectrography							
rganic lfur	Btu/lb	Reducing Atmosphere				Oxidizing Atmosphere											
		IDT	ST,S	ST,H	FT	IDT	ST,S	ST,H	FT	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	TiO_2	Na_2O	K_2O
.81	13,686	1980	2100		2520	2535	2575		2610	46.0	21.5	27.0	0.58	0.94	0.92	0.27	1.7
.82	13,756	1945	2050		2500	2530	2570		2600	44.0	21.0	29.5	0.45	0.98	0.92	0.34	1.5
.76	12,281	2000	2085		2460	2540	2570		2585	45.0	20.0	30.0	0.42	0.55	0.86	0.28	1.8
.86	13,396	1940	2020		2420	2540	2560		2580	41.0	20.0	34.0	0.40	0.82	0.88	0.29	2.1
.51	8,943	2040	2115		2420	2545	2580		2620	47.0	21.0	28.5	0.42	0.36	0.80	0.18	1.7
.28	4,875	1980	2020		2480	2515	2560		2600	49.0	18.0	30.0	0.51	0.42	0.83	0.24	2.3
.78	12,303																
.20	3,649	2050	2130		2630	2510	2560		2645	53.0	19.5	20.5	0.76	1.23	0.93	0.27	2.2
.52	9,172	2000	2090		2480	2530	2565		2600	48.0	20.0	28.0	0.45	0.40	0.83	0.18	1.7
.14	2,646	2180	2430		2615	2580	2670		2750+	56.0	23.5	14.3	0.85	1.14	1.04	0.27	2.3
.25	2,784	2440	2450		2460	2750+	2750+		2750+	6.70*	2.00*	90.0*	0.29	0.16	<0.1	0.02	<0.1
.20	3,466																
.23	3,175	1960	1980		2200	2510	2580		2600	34.0	11.7	49.0	0.48	1.14	0.58	0.12	1.4
.10	1,560	2135	2380		2700	2480	2610		2710	56.0	21.7	13.0	0.87	2.03	0.91	0.27	2.0
.35	2,868	2450	2455		2460	2750+	2750+		2750+	6.70*	2.30*	90.0*	0.25	0.18	<0.1	0.02	<0.1
.23	2,247																
.77	12,819																
.76	12,998	1940	1990		2360	2520	2560		2590	44.0	19.5	31.0	0.58	1.08	0.88	0.26	1.8

IDT - Initial Deformation Temperature
ST,S - Softening Temperature, Spherical
ST,H - Softening Temperature, Hemispherical
FT - Fluid Temperature

* Extrapolated Values

TABLE B-44

SCREEN ANALYSIS

Coal Identification Franklin L. B. Seam, Garrett County, Maryland

BCR Sample No. 2579

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

Screen Size	Weight Percent	Cumulative
plus 1/4 in.	8.4	8.4
1/4 in. x 6 M	25.8	34.2
6 M x 12 M	22.5	56.7
minus 12 M	43.3	100.0
Total	100.0	

Zones A, B and C from 3/8 Inch x 0 Run (7-20-70) Crushed to 30 Mesh x 0

Screen Size	Weight Percent	Cumulative
plus 30 M	10.1	10.1
30 M x 50 M	35.0	45.1
50 M x 100 M	22.3	67.4
minus 100 M	32.6	100.0
Total	100.0	

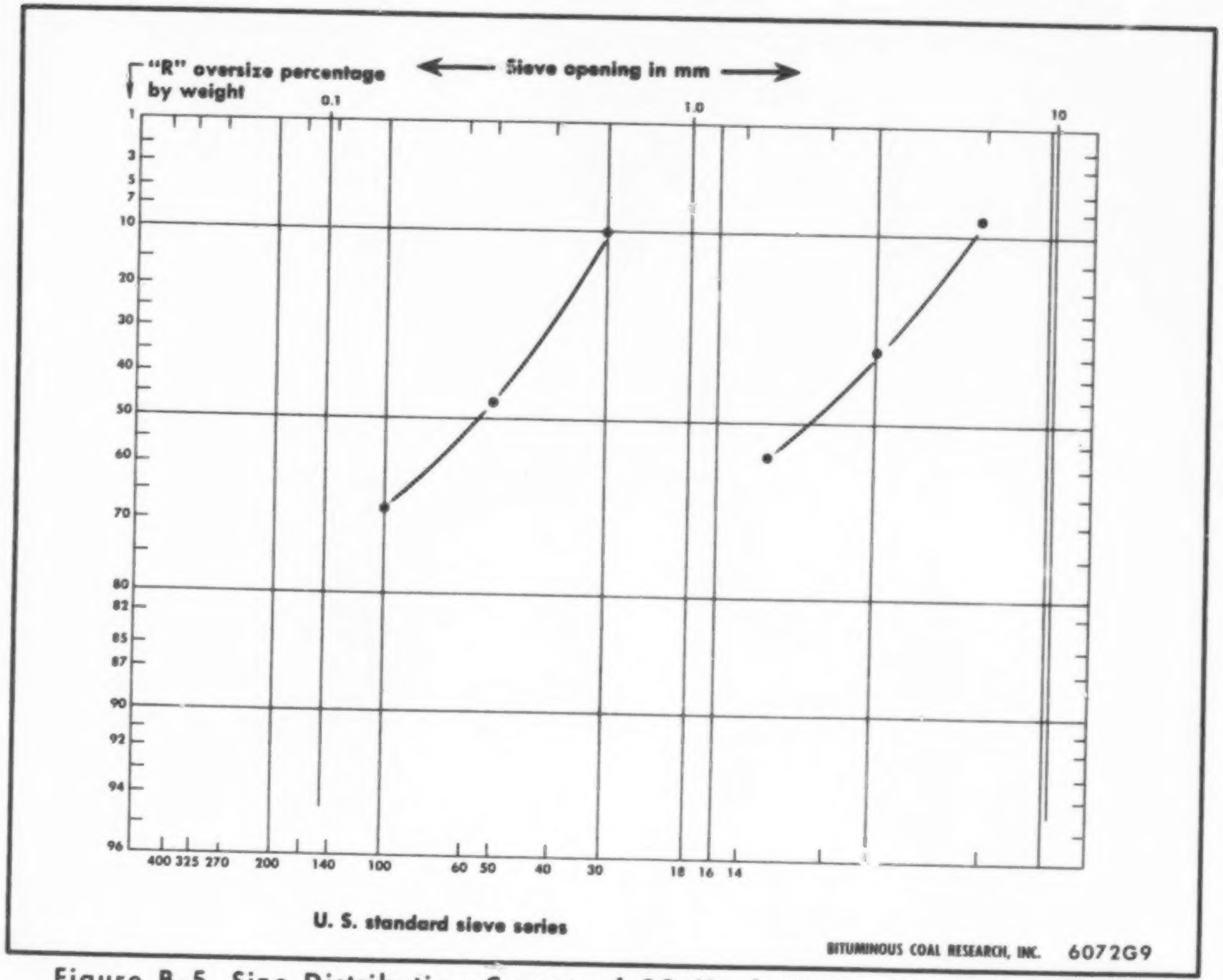

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Figure B-5. Size Distribution Curves of 30 Mesh X 0 and 3/8 Inch X 0 Concentrating Table Feeds for Franklin L. B. Seam, Garrett County, Maryland, BCR Sample No. 2579

TABLE B-45

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--3/8 Inch x 0 Rough Cleaning and Pyrite Precleaning

Coal Identification Franklin L. B. Seam. Garrett County, Maryland

Raw Run-of-Mine Coal Crushed to 3/8 inch x 0

BCR Sample No. 2579

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	46.3		0.61	15.6	3.12	
Zone B	33.5		0.54	16.8	3.44	
Zone C						
Float at 1.60	2.0	21.2	0.52	18.2	3.88	
1.60 by 1.90	2.3	24.4	0.64	40.4	6.34	46.0
Sink at 1.90	5.0	54.4	0.62	63.0	6.16	25.7
Composite	9.3	100.0		48.0	5.72	
Zone D						
Float at 1.90	2.2	28.4	0.42	37.4	6.86	48.5
1.90 by 2.95	5.1	65.2	0.47	74.9	6.47	14.2
Sink at 2.95	0.5	6.4	0.32	59.9	39.5	11.1
Composite	7.8	100.0		63.3	8.69	23.7
Zone E						
Float at 2.95	2.3	73.3	0.54	76.4	9.38	
Sink at 2.95	0.8	26.7	0.36	60.6	39.0	
Composite	3.1	100.0		72.2	17.3	
Composite of Zones A, B, C	89.1			19.4	3.51	
Composite of 1.60 Float Fractions	81.8			16.2	3.27	
Composite of 2.95 Sink Fractions	1.3			60.3	39.2	
Composite of Table Products	100.0			24.5	4.34	
Analysis of Feed to Table			0.47	23.6	4.28	

Run Date: 7-20-70

TABLE B-46

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--30 Mesh x 0 Deep Cleaning

Coal Identification Franklin L. B. Seam, Garrett County, Maryland

Zones A, B, and C, 3/8 Inch x 0 Run (7-20-70) Crushed to 30 Mesh x 0

BCR Sample No. 2579

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	74.9		0.35	14.5	2.74	
Zone B	13.4		0.24	17.1	2.83	
Zone C						
Float at 1.60	1.6	71.0	0.60	21.1	3.13	
Sink at 1.60	0.7	29.0	0.56	40.1	7.30	
Composite	2.3	100.0		26.6	4.34	
Zone D						
Float at 1.60	1.3	14.4	0.54	27.2	3.78	
1.60 by 2.95	7.4	83.7	0.39	51.1	7.48	
Sink at 2.95	0.2	1.9	0.22	60.7	40.7	
Composite	8.9	100.0		47.3	7.58	
Zone E						
Float at 2.95	0.1	29.5	0.38	62.6	20.6	
Sink at 2.95	0.4	70.5	0.30	61.5	41.9	
Composite	0.5	100.0		61.8	35.6	
Composite of Zones A, B, C	90.6			15.2	2.79	
Composite of 1.60 Float Fractions	91.2			15.2	2.77	
Composite of 2.95 Sink Fractions	0.6			61.2	41.5	
Composite of Table Products	100.0			18.3	3.38	
Analysis of Feed to Table			0.72	18.6	3.52	

Run Date: 8-7-70

TABLE B-47

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--Effects of Two-stage Cleaning

Coal Identification Franklin L. B. Seam, Garrett County, Maryland

Composite of 3/8 Inch x 0 Run (7-20-70) and 30 Mesh x 0 Run (8-7-70)

BCR Sample No. 2579

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	66.7			14.5	2.74	
Zone B	11.9			17.1	2.83	
Zone C						
Float at 1.60	1.5	71.0		21.1	3.13	
Sink at 1.60	0.6	29.0		40.1	7.30	
Composite	2.1	100.0		26.6	4.34	
Zone D						
Float at 2.95	15.0	95.5		55.3	6.76	
Sink at 2.95	0.7	4.5		60.1	39.8	
Composite	15.7	100.0		55.5	8.25	
Zone E						
Float at 2.95	2.4	66.7		75.8	9.85	
Sink at 2.95	1.2	33.3		60.9	40.0	
Composite	3.6	100.0		70.8	19.9	
Composite of Zones A, B, C	80.7			15.2	2.79	
Composite of 1.60 Float Fractions	80.1			15.0	2.76	
Composite of 2.95 Sink Fractions	1.9			60.6	39.9	
Composite of Table Products	100.0			23.5	4.27	
Analysis of Feed to Table				23.6	4.28	

TABLE B-48

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table No. 15-S Tests - Pyrite Beneficiation

Coal Identification Franklin L. B. Seam, Garrett County, Maryland

Zone E, 3/8 Inch x 0 Run (7-20-70) Crushed to 30 Mesh x 0

BCR Sample No. 2579

Table Products	Product, Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
		Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	11.9	0.33	63.8	17.6	
Zone B	13.8	0.42	63.8	16.2	
Zone C	4.3	0.47	63.4	16.0	
Zone D	62.9	0.35	75.6	16.4	8.5
Zone E	7.1	0.24	64.7	42.8	5.3
Composite of Table Products	100.0		71.3	18.4	
Analysis of Feed to Table		0.43	70.8	18.0	

Run Date: 8-6-70

TABLE B-49

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table No. 15-S Tests - Pyrite Beneficiation

Coal Identification Franklin L. B. Seam, Garrett County, Maryland

Zone D, 30 Mesh x 0 Run (8-6-70) Crushed to 60 Mesh x 0

BCR Sample No. 2579

Table Products	Product, Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
		Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	40.5	0.60	76.8	11.0	
Zone B	36.5	0.60	77.4	11.2	
Zone C	9.7	0.62	77.4	9.47	
Zone D	9.0	0.52	80.4	11.4	7.0
Zone E	4.3	0.30	73.4	31.6	3.3
Composite of Table Products	100.0		77.3	11.8	
Analysis of Feed to Table		0.50	77.0	12.2	

Run Date: 9-8-70

TABLE B-50

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Pyrite Beneficiation - Effects of Two-stage Cleaning

Coal Identification Franklin L. B. Seam, Garrett County, Maryland

BCR Sample No. 2579

Pyrite Precleaning

Concentrating Table No. 14 Test Run Date 7-20-70
Feed to Concentrating Table: Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	23.6	4.28
Zone E (Pyrite Zone)	3.1	72.2	17.3

Pyrite Cleaning

Concentrating Table No. 15-S Test Run Date 8-6-70
Feed to Concentrating Table: Zone E, 3/8 Inch x 0 Run (7-20-70) Crushed to 30 Mesh x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	70.8	18.0
Zone E (Pyrite Zone)	7.1	64.7	42.8

Concentrating Table No. 15-S Test Run Date 9-8-70
Feed to Concentrating Table: Zone D, 30 Mesh x 0 Run (8-6-70) Crushed to 60 Mesh x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	77.0	12.2
Zone E (Pyrite Zone)	4.3	73.4	31.6

Two Stage Pyrite Product	0.30	67.0	39.8

TABLE B-51

Flowsheet for Pyrite Beneficiation Tests

Franklin L. B. Seam, Garrett County, Maryland
BCR Sample No. 2579
Basis:
Pounds of Total Sulfur/Ton of
Run-of-Mine Coal

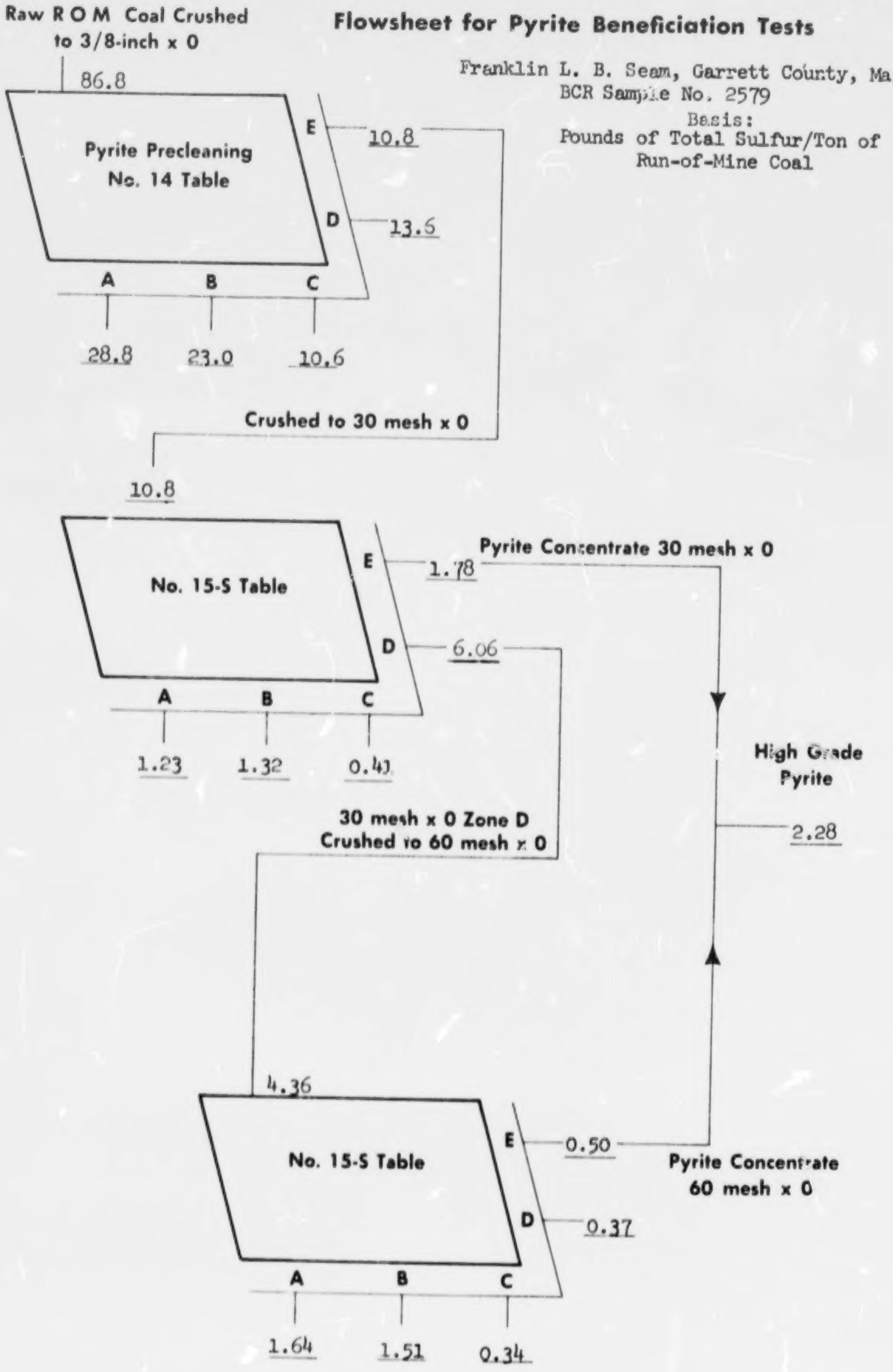
Raw R O M Coal Crushed to 3/8-inch x 0
86.8
Pyrite Precleaning No. 14 Table
E
10.8
D
13.6
A
B
C
28.8
23.0
10.6
Crushed to 30 mesh x 0
10.8
No. 15-S Table
E
1.78
Pyrite Concentrate 30 mesh x 0
D
6.06
A
B
C
1.23
1.32
0.41
High Grade Pyrite
2.28
30 mesh x 0 Zone D Crushed to 60 mesh x 0
4.36
No. 15-S Table
E
0.50
Pyrite Concentrate 60 mesh x 0
D
0.37
A
B
C
1.64
1.51
0.34

TABLE B-52

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Flowsheet Data for Pyrite Beneficiation Tests

Coal Identification Franklin L. B. Seam, Garrett County, Maryland

BCR Sample No. 2579

Fraction	Weight Percent		Chemical Analysis, Dry Basis Weight Percent	
			Ash	Total Sulfur
Table No. 14				
Zone A	46.3		15.6	3.12
Zone B	33.5		16.8	3.44
Zone C	9.3		48.0	5.72
Zone D	7.8		63.3	8.69
Zone E		3.1	72.2	17.3
Table No. 15-S (30 Mesh x 0)				
Zone A	0.37		63.8	17.6
Zone B	0.43		63.8	16.2
Zone C	0.13		63.4	16.0
Zone D		1.95	75.6	16.4
Zone E	0.22		64.7	42.8
Table No. 15-S (60 Mesh x 0)				
Zone A	0.79		76.8	11.0
Zone B	0.71		77.4	11.2
Zone C	0.19		77.4	9.47
Zone D	0.18		80.4	11.4
Zone E	0.08		73.4	31.6
Composite of Fractions	100.0		24.5	4.29
Analysis of Feed Coal			23.6	4.28

A

TABLE B-53

Evaluation of Coal Cleaning Processes and Tech
for Removing Pyritic Sulfur from Fine Coa

Concentrating Table Tests--3/8 Inch x 0 Rough Cl

Ash Characteristics

Coal Identification Franklin L. B. Seam, Garrett County, Maryland

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

BO

Table Products	Product Weight Percent	Float and Sink Weight %	Chemical Analysis, Dry Basis, Weight Percent							Reducing Atmosphe		
			Moisture	Ash	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Btu/lb	IDT	ST,S	ST,H
Zone A	46.3		0.61	15.6	3.12	0.03	2.27	0.82	13,018	2110	2240	
Zone B	33.5		0.54	16.8	3.44	0.04	2.58	0.82	12,825	2080	2210	
Zone C			0.36	47.2	5.87	0.04	5.29	0.54	7,504	2160	2380	
1.60 Float	2.0	21.2	0.52	18.2	3.88	0.01	3.04	0.80	12,586	2040	2175	
1.60 by 1.90	2.3	24.4	0.64	40.4	6.34	0.04	5.68	0.62	8,578	2060	2210	
1.90 Sink	5.0	54.4	0.62	63.0	6.16	0.05	5.79	0.32	4,757	2180	2420	
Composite	9.3	100.0		48.0	5.72	0.04	5.18	0.50	7,349			
Zone D			0.40	70.8	7.73	0.08	7.35	0.30	3,622	2170	2390	
1.90 Float	2.2	28.4	0.42	37.4	6.86	0.05	6.17	0.64	9,122	2020	2160	
1.90 by 2.95	5.1	65.2	0.47	74.9	6.47	0.04	6.25	0.18	2,848	2300	2455	
2.95 Sink	0.5	6.4	0.32	59.9	39.5	0.26	38.7	0.56	3,592	2425	2430	
Composite	7.8	100.0		63.3	8.69	0.06	8.30	0.33	4,677			
Zone E			0.29	71.5	17.8	0.16	17.2	0.44	2,874	1960	1985	
2.95 Float	2.3	73.3	0.54	76.4	9.38	0.08	9.11	0.19	2,434	2140	2320	
2.95 Sink	0.8	26.7	0.36	60.6	39.0	0.28	38.0	0.71	3,538	2420	2440	
Composite	3.1	100.0		72.2	17.3	0.13	16.8	0.32	2,742			
Composite of Table Products	100.0			24.5	4.34	0.04	3.57	0.73	11,457			
Analysis of Feed to Table			0.47	23.6	4.28	0.14	3.37	0.77	11,583	2070	2205	

Run Date: 7-20-70

IDT - Initi
ST,S - Softe
ST,H - Softe
FT - Fluid

B

ABLE B-53

Processes and Techniques
ulfur from Fine Coal

8 Inch x 0 Rough Cleaning

ristics

County, Maryland

to 3/8 Inch x 0

BCR Sample No. 2579

Ash Fusibility								Ash Spectrography							
Reducing Atmosphere				Oxidizing Atmosphere											
IDT	ST,S	ST,H	FT	IDT	ST,S	ST,H	FT	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	TiO_2	Na_2O	K_2O
2110	2240		2500	2535	2580		2725	51.5	21.2	20.5	0.65	0.37	1.05	0.29	3.6
2080	2210		2470	2530	2575		2720	51.5	20.7	20.0	0.61	0.37	1.07	0.33	3.9
2160	2380		2690	2525	2615		2745	58.0	18.5	14.6	0.58	0.36	1.08	0.19	5.1
2040	2175		2550	2520	2560		2725	52.5	19.7	21.0	0.46	0.40	1.05	0.22	3.1
2060	2210		2480	2500	2580		2750+	55.0	19.0	18.0	0.58	0.34	1.01	0.19	4.8
2180	2420		2660	2520	2640		2750+	59.0	21.0	12.3	0.58	0.38	1.02	0.17	4.3
2170	2390		2730	2540	2630		2750+	58.0	20.1	13.8	0.49	0.58	1.04	0.19	4.7
2020	2160		2580	2515	2560		2670	54.0	19.0	20.0	0.52	0.36	0.98	0.20	4.6
2300	2455		2750	2540	2675		2750+	60.0	21.5	11.3	0.52	0.60	1.00	0.19	4.6
2425	2430		2435	2750+	2750+		2750+	9.60*	3.70*	85.0*	0.28	0.32	0.11	<0.02	<0.1
1960	1985		2270	2500	2560		2590	47.0	15.0	32.0	0.37	0.49	0.77	0.13	2.2
2140	2320		2665	2515	2600		2750+	53.0	21.8	18.0	0.64	0.52	1.12	0.19	4.4
2420	2440		2445	2750+	2750+		2750+	9.20*	5.30*	83.0*	0.30	0.26	0.50	0.02	0.1
2070	2205		2455	2505	2565		2665	54.0	20.4	20.0	0.61	0.45	0.98	0.25	3.1

IDT - Initial Deformation Temperature
ST,S - Softening Temperature, Spherical
ST,H - Softening Temperature, Hemispherical
FT - Fluid Temperature

*Extrapolated Values

TABLE B-54

SCREEN ANALYSIS

Coal Identification Upper Freeport Seam, Preston County, West Virginia

BCR Sample No. 2630

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

Screen Size	Weight Percent	Cumulative
plus 1/4 in.	7.9	7.9
1/4 in. x 6 M	25.3	33.2
6 M x 12 M	21.2	54.4
minus 12 M	45.6	100.0
Total	100.0	

Zones A, B and C from 3/8 Inch x 0 Run (8-12-70) Crushed to 30 Mesh x 0

Screen Size	Weight Percent	Cumulative
plus 30 M	5.5	5.5
30 M x 50 M	34.1	39.6
50 M x 100 M	26.4	66.0
minus 100 M	34.0	100.0
Total	100.0	

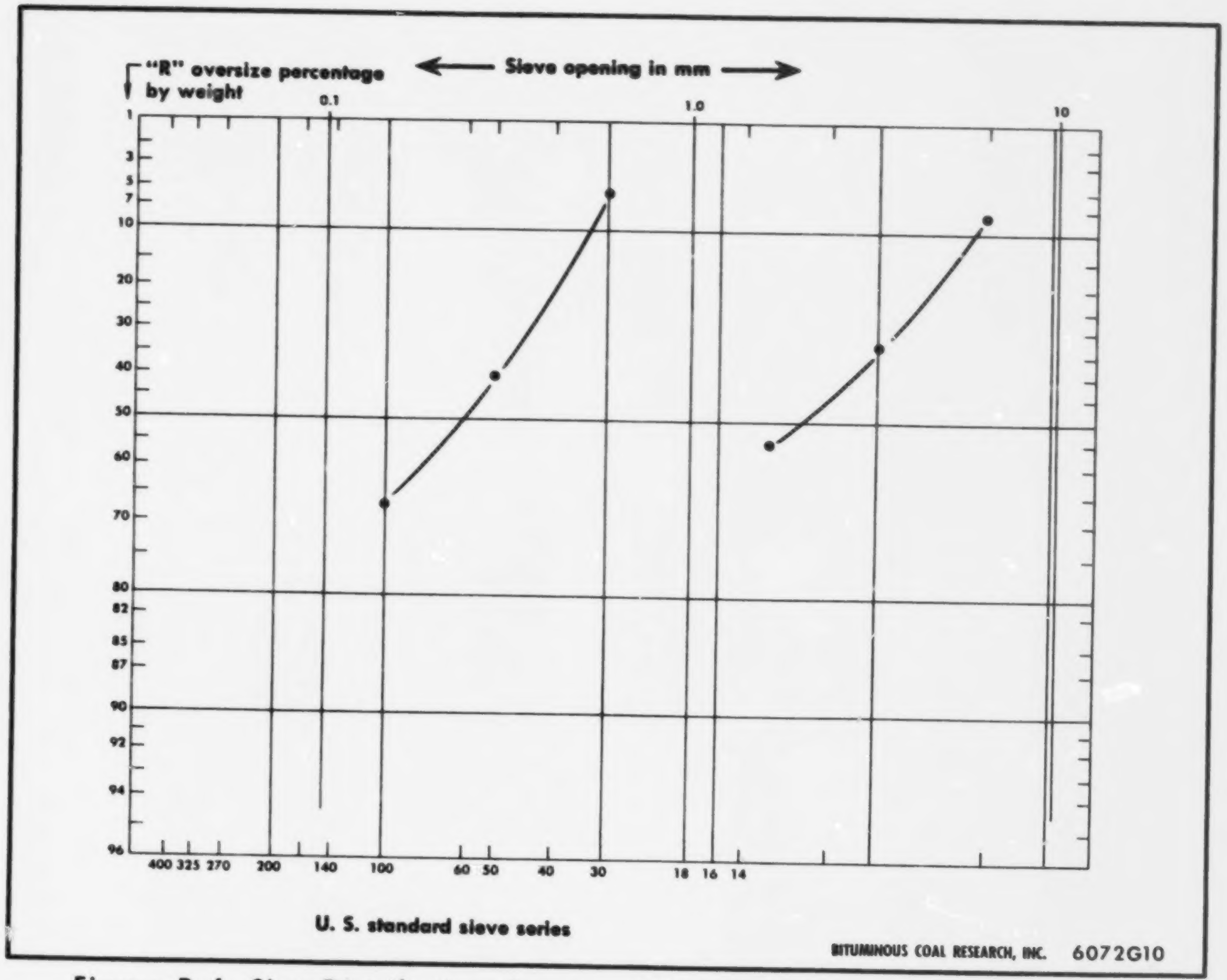

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Figure B-6. Size Distribution Curves of 30 Mesh X 0 and 3/8 Inch X 0 Concentrating Table Feeds for Upper Freeport Seam, Preston County, West Virginia, BCR Sample No. 2630

TABLE B-55

Evaluation of Coal Cleaning Processes and Techniques
for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--3/8 Inch x 0 Rough Cleaning and Pyrite Precleaning

Coal Identification Upper Freeport Seam, Preston County, West Virginia

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

BCR Sample No. 2630

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	54.4		0.82	7.69	1.09	
Zone B	23.3		0.48	9.20	1.20	
Zone C						
Float at 1.60	1.6	25.3	0.56	19.8	2.24	
1.60 by 1.90	3.4	54.3	0.32	43.2	3.24	44.9
Sink at 1.90	1.2	20.4	0.50	58.8	7.00	28.8
Composite	6.2	100.0		40.5	3.75	
Zone D						
Float at 1.90	0.8	8.5	0.56	44.0	3.26	43.4
1.90 by 2.95	8.3	90.8	1.11	78.6	4.00	12.1
Sink at 2.95	0.1	0.7	0.58	59.1	37.6	13.8
Composite	9.2	100.0		75.5	4.17	14.8
Zone E						
Float at 2.95	4.5	64.8	0.77	77.4	6.92	
Sink at 2.95	2.4	35.2	0.30	60.2	42.2	
Composite	6.9	100.0		71.3	19.3	
Composite of Zones A, B, C	83.9			10.5	1.32	
Composite of 1.60 Float Fractions	79.3			8.38	1.15	
Composite of 2.95 Sink Fractions	2.5			60.1	42.0	
Composite of Table Products	100.0			20.7	2.82	
Analysis of Feed to Table			1.36	18.4	2.32	

Run Date: 8-12-70

TABLE B-56

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--30 Mesh x 0 Deep Cleaning

Coal Identification Upper Freeport Seam, Preston County, West Virginia

Zones A, B, and C, 3/8 Inch x 0 Run (8-12-70) Crushed to 30 Mesh x 0

BCR Sample No. 2630

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	77.9		0.41	7.87	1.01	
Zone B	14.2		0.50	9.58	1.06	
Zone C						
Float at 1.60	0.7	89.2	0.45	14.3	1.36	
Sink at 1.60	0.1	10.8	0.54	53.6	5.09	
Composite	0.8	100.0		18.5	1.76	
Zone D						
Float at 1.60	2.0	30.5	0.64	25.8	1.80	
1.60 by 2.95	4.4	68.0	0.64	54.6	3.90	
Sink at 2.95	0.1	1.5	0.70	61.3	37.8	
Composite	6.5	100.0		45.9	3.77	
Zone E						
Float at 2.95	0.1	21.6	0.58	64.4	20.6	
Sink at 2.95	0.5	78.4	0.30	61.0	43.4	
Composite	0.6	100.0		61.7	38.5	
Composite of Zones A, B, C	92.9			8.23	1.02	
Composite of 1.60 Float Fractions	94.8			8.55	1.04	
Composite of 2.95 Sink Fractions	0.6			61.1	42.5	
Composite of Table Products	100.0			11.0	1.43	
Analysis of Feed to Table			0.68	11.0	1.50	

Run Date: 8-21-70

TABLE B-57

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--Effects of Two-stage Cleaning

Coal Identification Upper Freeport Seam, Preston County, West Virginia

Composite of 3/8 Inch x 0 Run (8-12-70) and 30 Mesh x 0 Run (8-21-70)

BCR Sample No. 2630

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	65.4			7.87	1.01	
Zone B	11.9			9.58	1.06	
Zone C						
Float at 1.60	0.6	89.2		14.3	1.36	
Sink at 1.60	0.1	10.8		53.6	5.09	
Composite	0.7	100.0		18.5	1.76	
Zone D						
Float at 2.95	14.4	98.6		64.6	3.68	
Sink at 2.95	0.2	1.4		59.7	37.7	
Composite	14.6	100.0		64.5	4.16	
Zone E						
Float at 2.95	4.6	62.2		77.1	7.22	
Sink at 2.95	2.8	37.8		60.3	42.4	
Composite	7.4	100.0		70.7	20.5	
Composite of Zones A, B, C	78.0			8.23	1.02	
Composite of 1.60 Float Fractions	77.9			8.18	1.02	
Composite of 2.95 Sink Fractions	3.0			60.3	42.1	
Composite of Table Products	100.0			21.1	2.92	
Analysis of Feed to Table			1.36	18.4	2.32	

TABLE B-58

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table No. 15-S Tests - Pyrite Beneficiation

Coal Identification Upper Freeport Seam, Preston County, West Virginia

Zone E, 3/8 Inch x 0 Run (8-12-70) Crushed to 30 Mesh x 0

BCR Sample No. 2630

Table Products	Product, Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
		Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	11.4	0.53	63.6	15.6	
Zone B	12.5	0.46	63.6	14.7	
Zone C	4.1	0.58	65.6	11.6	
Zone D	62.7	0.23	76.2	17.0	7.5
Zone E	9.3	0.15	63.3	46.4	5.5
Composite of Table Products	100.0		71.6	19.1	
Analysis of Feed to Table		0.72	71.4	18.9	

Run Date: 9-2-70

TABLE B-59

Evaluation of Coal Cleaning Processes and Techniques
for Removing Pyritic Sulfur from Fine Coal

Concentrating Table No. 15-S Tests - Pyrite Beneficiation

Coal Identification Upper Freeport Seam, Preston County, West Virginia

Zone D, 30 Mesh x 0 Run (9-2-70) Crushed to 60 Mesh x 0

BCR Sample No. 2630

Table Products	Product, Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
		Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	16.7	0.82	75.7	14.8	
Zone B	31.4	0.74	76.1	13.0	
Zone C	14.1	0.95	76.0	10.4	
Zone D	24.2	0.84	79.6	11.8	6.3
Zone E	13.6	0.20	65.0	45.3	3.1
Composite of Table Products	100.0		75.4	17.0	
Analysis of Feed to Table		0.70	76.0	17.9	

Run Date: 9-18-70

TABLE B-60

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Pyrite Beneficiation - Effects of Two-stage Cleaning

Coal Identification Upper Freeport Seam, Preston County, West Virginia

BCR Sample No. 2630

Pyrite Precleaning

Concentrating Table No. 14 Test Run Date 8-12-70

Feed to Concentrating Table: Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	18.4	2.32
Zone E (Pyrite Zone)	6.9	71.3	19.3

Pyrite Cleaning

Concentrating Table No. 15-S Test Run Date 9-2-70

Feed to Concentrating Table: Zone E, 3/8 Inch x 0 Run (8-12-70) Crushed to 30 Mesh x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	71.4	18.9
Zone E (Pyrite Zone)	9.3	63.3	46.4

Concentrating Table No. 15-S Test Run Date 9-18-70

Feed to Concentrating Table: Zone D, 30 Mesh x 0 Run (9-2-70) Crushed to 60 Mesh x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	76.0	17.9
Zone E (Pyrite Zone)	13.6	65.0	45.3

Two Stage Pyrite Product	1.2	64.2	45.9

TABLE B-61

Flowsheet for Pyrite Beneficiation Tests

Upper Freeport Seam, Preston County, W. Va.
BCR Sample No. 2630
Basis:
Pounds of Total Sulfur/Ton of
Run-of-Mine Coal

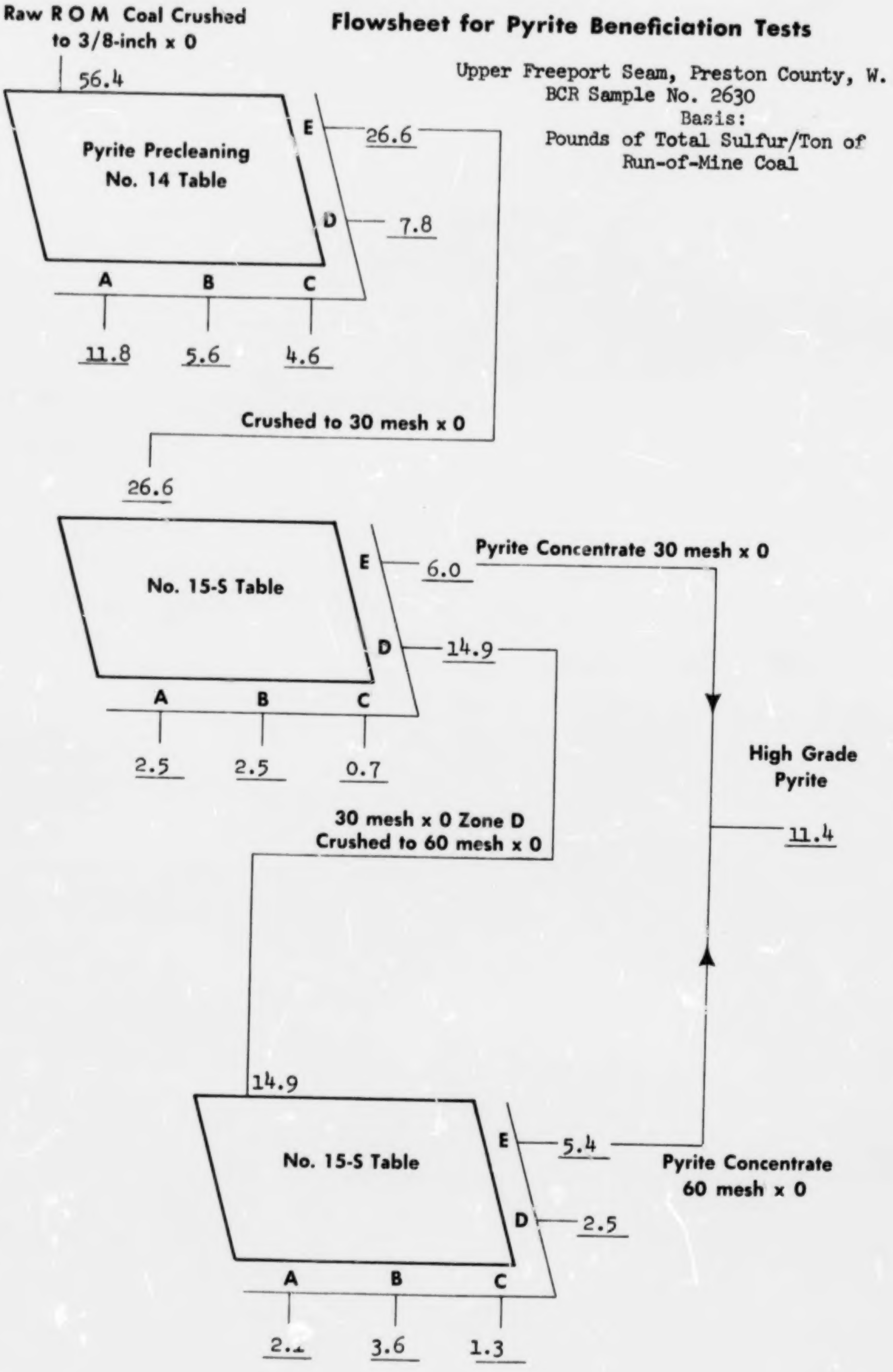
Raw R O M Coal Crushed to 3/8-inch x 0
56.4
Pyrite Precleaning No. 14 Table
E
26.6
D
7.8
A
B
C
11.8
5.6
4.6
Crushed to 30 mesh x 0
26.6
No. 15-S Table
E
6.0
Pyrite Concentrate 30 mesh x 0
D
14.9
A
B
C
2.5
2.5
0.7
High Grade Pyrite
11.4
30 mesh x 0 Zone D Crushed to 60 mesh x 0
14.9
No. 15-S Table
E
5.4
Pyrite Concentrate 60 mesh x 0
D
2.5
A
B
C
2.1
3.6
1.3

TABLE B-62

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Flowsheet Data for Pyrite Beneficiation Tests

Coal Identification **Upper Freeport Seam, Preston County, West Virginia**

BCR Sample No. 2630

Fraction	Weight Percent		Chemical Analysis, Dry Basis Weight Percent	
			Ash	Total Sulfur
Table No. 14				
Zone A	54.4		7.69	1.09
Zone B	23.3		9.20	1.20
Zone C	6.2		40.5	3.75
Zone D	9.2		75.5	4.17
Zone E		6.9	71.3	19.3
Table No. 15-S (30 Mesh x 0)				
Zone A	0.8		63.6	15.6
Zone B	0.9		63.6	14.7
Zone C	0.3		65.6	11.6
Zone D		4.3	76.2	17.0
Zone E	0.6		63.3	46.4
Table No. 15-S (60 Mesh x 0)				
Zone A	0.7		75.7	14.8
Zone B	1.4		76.1	13.0
Zone C	0.6		76.0	10.4
Zone D	1.0		79.6	11.8
Zone E	0.6		65.0	45.3
Composite of Fractions	100.0		20.7	2.80
Analysis of Feed Coal			18.4	2.32

A

TABLE B-63

Evaluation of Coal Cleaning Processes and Techniq
for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--3/8 Inch x 0 Rough Clean

Ash Characteristics

Coal Identification Upper Freeport Seam, Preston County, West Virginia

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

BCR S

Table Products	Product Weight Percent	Float and Sink Weight %	Chemical Analysis, Dry Basis, Weight Percent							Ash			
										Reducing Atmosphere			
			Moisture	Ash	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Btu/lb	IDT	ST,S	ST,H	F
Zone A	54.4		0.82	7.69	1.09	0.06	0.50	0.53	14,275	2510	2680		275
Zone B	23.3		0.48	9.20	1.20	0.06	0.61	0.53	14,036	2620	2725		275
Zone C			0.44	39.5	3.40	0.02	3.04	0.34	8,842	2600	2690		275
1.60 Float	1.6	25.3	0.56	19.8	2.24	0.02	1.68	0.54	12,159	2645	2720		275
1.60 by 1.90	3.4	54.3	0.32	43.2	3.24	0.02	2.83	0.39	8,208	2620	2750+		275
1.90 Sink	1.2	20.4	0.50	58.8	7.00	0.06	6.64	0.30	5,318	2130	2510		271
Composite	6.2	100.0		40.5	3.75	0.03	3.31	0.41	8,618				
Zone D			0.54	75.3	3.48	0.02	3.34	0.12	2,792	2600	2740		275
1.90 Float	0.8	8.5	0.56	44.0	3.26	0.03	2.87	0.36	8,068	2600	2745		275
1.90 by 2.95	8.3	90.8	1.11	78.6	4.00	0.03	3.80	0.17	2,070	2660	2750+		275
2.95 Sink	0.1	0.7	0.58	59.1	37.6	0.40	36.7	0.52	4,212	2350	2430		244
Composite	9.2	100.0		75.5	4.17	0.03	3.95	0.19	2,595				
Zone E			0.38	72.0	17.4	0.13	17.0	0.26	3,044	1985	2050		238
2.95 Float	4.5	64.8	0.77	77.4	6.92	0.10	6.65	0.17	2,332	2440	2580		275
2.95 Sink	2.4	35.2	0.30	60.2	42.2	0.46	41.2	0.50	3,690	2410	2440		245
Composite	6.9	100.0		71.3	19.3	0.23	18.8	0.29	2,810				
Composite of Table Products	100.0			20.7	2.82	0.07	2.28	0.47	12,003				
Analysis of Feed to Table			1.36	18.4	2.32	0.08	1.77	0.47	12,497	2280	2550		272

Run Date: 8-12-70

IDT - Initial
ST,S - Softeni
ST,H - Softeni
FT - Fluid T

B

TABLE B-63

Coal Cleaning Processes and Techniques
ing Pyritic Sulfur from Fine Coal

ble Tests--3/8 Inch x 0 Rough Cleaning

Ash Characteristics

Seam, Preston County, West Virginia

Coal Crushed to 3/8 Inch x 0

BCR Sample No. 2630

sis,		Ash Fusibility								Ash Spectrography							
		Reducing Atmosphere				Oxidizing Atmosphere											
ganic lfur	Btu/lb	IDT	ST,S	ST,H	FT	IDT	ST,S	ST,H	FT	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	TiO_2	Na_2O	K_2O
.53	14,275	2510	2680		2750+	2750+	2750+		2750+	49.0	31.0	11.3	0.75	2.18	1.20	0.31	3.5
.53	14,036	2620	2725		2750+	2745	2750+		2750+	51.5	30.5	10.9	0.78	1.77	1.25	0.28	2.8
.34	8,842	2600	2690		2750+	2730	2750+		2750+	54.0	26.5	11.7	0.78	0.38	1.17	0.26	4.5
.54	12,159	2645	2720		2750+	2750+	2750+		2750+	53.0	27.6	12.2	0.60	0.66	1.12	0.23	3.7
.39	8,208	2620	2750+		2750+	2750+	2750+		2750+	55.0	27.6	10.2	0.77	0.36	1.20	0.24	4.3
.30	5,318	2130	2510		2710	2560	2680		2750+	52.0	24.5	16.5	0.67	0.32	1.07	0.22	3.3
.41	8,618																
.12	2,792	2600	2740		2750+	2750+	2750+		2750+	62.0	24.7	6.80	0.67	0.31	1.25	0.19	2.5
.36	8,068	2600	2745		2750+	2750+	2750+		2750+	53.0	27.8	9.50	0.99	0.39	1.20	0.31	6.3
.17	2,070	2660	2750+		2750+	2750+	2750+		2750+	61.0	26.0	6.50	0.91	0.37	1.17	0.22	3.3
.52	4,212	2350	2430		2440	2750+	2750+		2750+	11.0	5.65	80.0	0.23	0.69	0.16	0.09	1.4
.19	2,595																
.26	3,044	1985	2050		2380	2525	2575		2635	44.0	18.8	31.5	0.49	0.31	0.89	0.16	2.0
.17	2,332	2440	2580		2750+	2695	2750+		2750+	57.0	24.6	13.5	0.60	0.30	1.16	0.19	2.5
.50	3,690	2410	2440		2450	2750+	2750+		2750+	8.4*	3.1*	85.0	0.25	0.30	<0.1	0.02	<0.1
.29	2,810																
.47	12,003																
.47	12,497	2280	2550		2725	2660	2740		2750+	51.0	26.5	15.7	0.75	1.02	1.22	0.22	3.9

IDT - Initial Deformation Temperature
ST,S - Softening Temperature, Spherical
ST,H - Softening Temperature, Hemispherical
FT - Fluid Temperature

* Extrapolated Values

TABLE B-64

SCREEN ANALYSIS

Coal Identification Illinois No. 6 Seam, Franklin County, Illinois

BCR Sample No. 2651

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

Screen Size	Weight Percent	Cumulative
plus 1/4 in.	14.9	14.9
1/4 in. x 6 M	29.6	44.5
6 M x 12 M	20.4	64.9
minus 12 M	35.1	100.0
Total	100.0	

Zones A, B and C from 3/8 Inch x 0 Run (9-3-70) Crushed to 30 Mesh x 0

Screen Size	Weight Percent	Cumulative
plus 30 M	6.9	6.9
30 M x 50 M	36.8	43.7
50 M x 100 M	24.7	68.4
minus 100 M	31.6	100.0
Total	100.0	

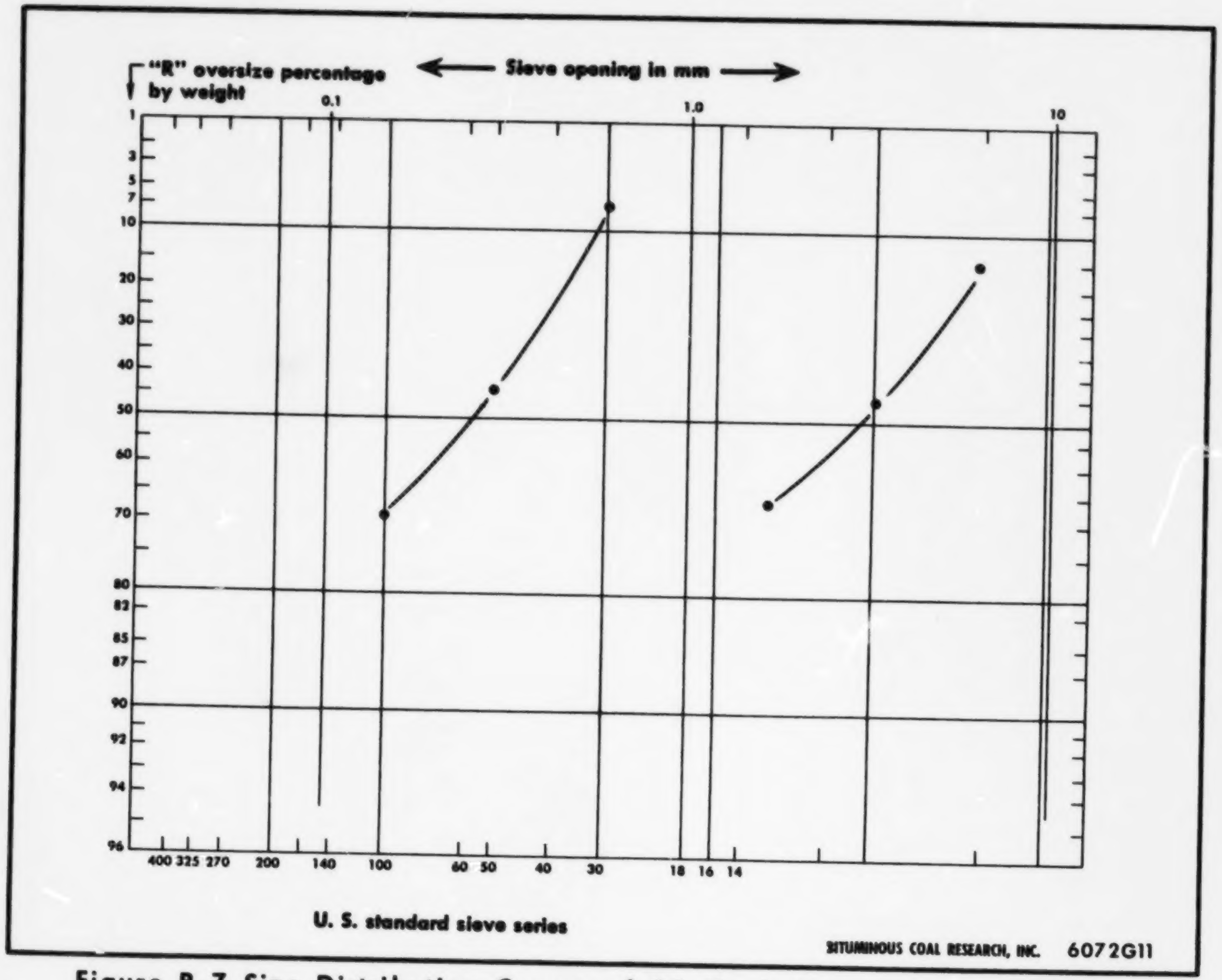

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Figure B-7 Size Distribution Curves of 30 Mesh X 0 and 3/8 Inch X 0 Concentrating Table Feeds for Illinois No. 6 Seam, Franklin County, Illinois, BCR Sample No. 2651

TABLE B-65

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--3/8 Inch x 0 Rough Cleaning and Pyrite Precleaning

Coal Identification Illinois No. 6 Seam, Franklin County, Illinois

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

BCR Sample No. 2651

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent: Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	29.9		0.92	8.03	2.30	
Zone B	28.4		1.07	7.96	2.24	
Zone C						
Float at 1.60	32.0	92.1	1.92	8.94	2.42	
1.60 by 1.90	1.9	5.5	2.26	37.5	5.00	46.0
Sink at 1.90	0.8	2.4	0.79	59.5	12.0	24.6
Composite	34.7	100.0		11.7	2.79	
Zone D						
Float at 1.90	0.8	19.4	1.84	36.6	6.98	44.9
1.90 by 2.95	3.1	69.6	1.96	69.0	10.3	15.6
Sink at 2.95	0.5	11.0	1.01	63.2	39.6	7.7
Composite	4.4	100.0		62.1	12.9	20.4
Zone E						
Float at 2.95	1.7	63.7	1.18	71.6	9.22	
Sink at 2.95	0.9	36.3	0.64	63.6	41.9	
Composite	2.6	100.0		68.7	21.1	
Composite of Zones A, B, C	93.0			9.38	2.46	
Composite of 1.60 Float Fractions	90.3			8.33	2.32	
Composite of 2.95 Sink Fractions	1.4			63.5	41.1	
Composite of Table Products	100.0			13.2	3.40	
Analysis of Feed to Table			1.16	13.4	3.45	

Run Date: 9-3-70

TABLE B-66

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--30 Mesh x 0 Deep Cleaning

Coal Identification Illinois No. 6 Seam, Franklin County, Illinois

Zones A, B, and C, 3/8 Inch x 0 Run (9-3-70) Crushed to 30 Mesh x 0

BCR Sample No. 2651

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	81.1		0.76	7.72	2.28	
Zone B	14.5		1.07	8.50	2.29	
Zone C						
Float at 1.60	1.0	93.9	1.28	11.8	2.40	
Sink at 1.60	0.1	6.1	1.31	49.0	11.4	
Composite	1.1	100.0		14.1	2.95	
Zone D						
Float at 1.60	1.65	56.8	1.08	22.8	3.18	
1.60 by 2.95	1.22	42.3	0.91	47.9	7.09	
Sink at 2.95	0.03	0.9	0.45	64.2	37.4	
Composite	2.9	100.0		33.8	5.14	
Zone E						
Float at 2.95	0.25	62.8	0.58	64.0	12.9	
Sink at 2.95	0.15	37.2	0.32	63.4	42.8	
Composite	0.4	100.0		63.8		
Composite of Zones A, B, C	96.7			7.91	2.29	
Composite of 1.60 Float Fractions	98.25			8.13	2.30	
Composite of 2.95 Sink Fractions	0.18			63.5	41.9	
Composite of Table Products	100.0			8.88	2.46	
Analysis of Feed to Table			1.20	8.98	2.44	

Run Date: 9-11-70

TABLE B-67

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--Effects of Two-stage Cleaning

Coal Identification Illinois No. 6 Seam, Franklin County, Illinois

Composite of 3/8 Inch x 0 Run (9-3-70) and 30 Mesh x 0 Run (9-11-70)

BCR Sample No. 2651

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	75.4			7.72	2.28	
Zone B	13.5			8.50	2.29	
Zone C						
Float at 1.60	0.9	93.9		11.8	2.40	
Sink at 1.60	0.1	6.1		49.0	11.4	
Composite	1.0	100.0		14.1	2.95	
Zone D						
Float at 2.95	6.58	92.7		50.4	7.67	
Sink at 2.95	0.52	7.3		63.2	39.5	
Composite	7.1	100.0		51.3	9.99	
Zone E						
Float at 2.95	1.95	65.0		70.6	9.69	
Sink at 2.95	1.05	35.0		63.6	42.0	
Composite	3.0	100.0		68.2	21.0	
Composite of Zones A, B, C	89.9			7.91	2.29	
Composite of 1.60 Float Fractions	89.8			7.88	2.28	
Composite of 2.95 Sink Fractions	1.57			63.5	41.2	
Composite of Table Products	100.0			12.8	3.40	
Analysis of Feed to Table			1.20	13.4	3.45	

TABLE B-68

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table No. 15-S Tests - Pyrite Beneficiation

Coal Identification Illinois No. 6 Seam, Franklin County, Illinois

Zone E, 3/8 Inch x 0 Run (9-3-70) Crushed to 30 Mesh x 0

BCR Sample No. 2651

Table Products	Product, Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
		Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	3.2	1.64	55.1	12.7	
Zone B	7.1	1.60	55.6	12.4	
Zone C	11.5	1.21	49.0	10.6	
Zone D	61.2	0.66	71.2	17.0	10.9
Zone E	17.0	0.22	65.8	45.2	4.0
Composite of Table Products	100.0		66.1	20.6	
Analysis of Feed to Table		0.51	66.7	20.6	

Run Date: 9-18-70

TABLE B-69

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table No. 15-S Tests - Pyrite Beneficiation

Coal Identification Illinois No. 6 Seam, Franklin County, Illinois

Zone D, 30 Mesh x 0 Run (9-18-70) Crushed to 60 Mesh x 0

BCR Sample No. 2651

Table Products	Product, Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
		Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	18.4	1.04	70.6	11.4	
Zone B	32.2	1.04	69.8	12.2	
Zone C	12.3	1.52	70.8	10.6	
Zone D	26.9	0.68	71.2	18.9	7.0
Zone E	10.2	0.25	65.2	47.7	2.9
Composite of Table Products	100.0		70.0	17.3	
Analysis of Feed to Table		1.02	70.8	16.8	

Run Date: 9-22-70

TABLE B-70

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Pyrite Beneficiation - Effects of Two-stage Cleaning

Coal Identification Illinois No. 6 Seam, Franklin County, Illinois

BCR Sample No. 2651

Pyrite Precleaning

Concentrating Table No. 14 Test Run Date 9-3-70

Feed to Concentrating Table: Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	13.4	3.45
Zone E (Pyrite Zone)	2.6	68.7	21.1

Pyrite Cleaning

Concentrating Table No. 15-S Test Run Date 9-18-70

Feed to Concentrating Table: Zone E, 3/8 Inch x 0 Run (9-3-70) Crushed to 30 Mesh x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	66.7	20.6
Zone E (Pyrite Zone)	17.0	65.8	45.2

Concentrating Table No. 15-S Test Run Date 9-22-70

Feed to Concentrating Table: Zone D, 30 Mesh x 0 Run (9-18-70) Crushed to 60 Mesh x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	70.8	17.3
Zone E (Pyrite Zone)	10.2	65.2	47.7

Two Stage Pyrite Product	0.60	65.6	45.9

TABLE B-71

Flowsheet for Pyrite Beneficiation Tests

Illinois No. 6 Seam, Franklin County, Illinois
BCR Sample No. 2651

Basis:
Pounds of Total Sulfur/Ton of
Run-of-Mine Coal

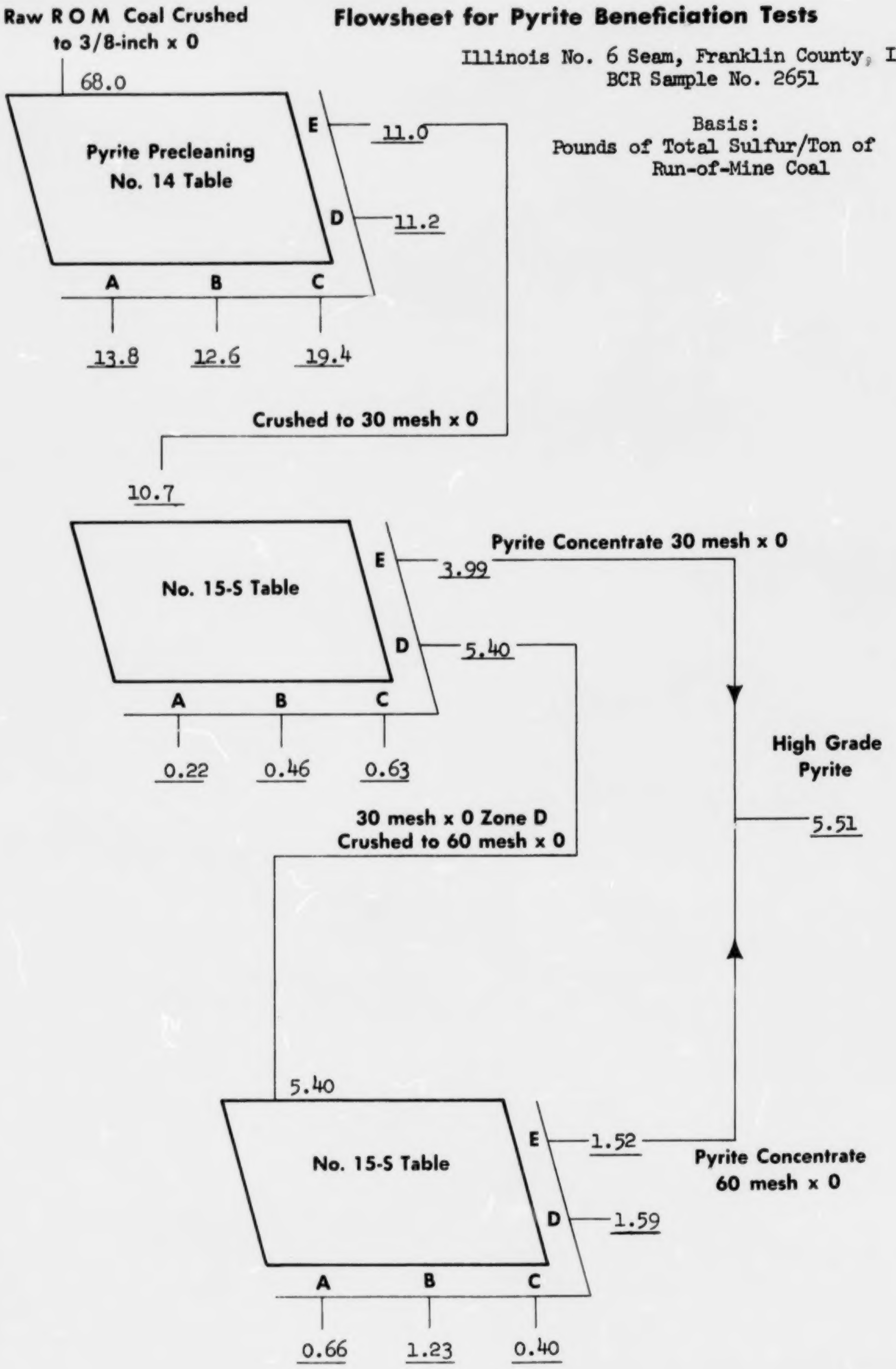

Raw R O M Coal Crushed to 3/8-inch x 0
68.0
Pyrite Precleaning No. 14 Table
E
11.0
D
11.2
A
B
C
13.8
12.6
19.4
Crushed to 30 mesh x 0
10.7
No. 15-S Table
E
3.99
Pyrite Concentrate 30 mesh x 0
D
5.40
A
B
C
0.22
0.46
0.63
30 mesh x 0 Zone D Crushed to 60 mesh x 0
High Grade Pyrite
5.51
5.40
No. 15-S Table
E
1.52
Pyrite Concentrate 60 mesh x 0
D
1.59
A
B
C
0.66
1.23
0.40

TABLE B-72

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Flowsheet Data for Pyrite Beneficiation Tests

Coal Identification Illinois No. 6 Seam, Franklin County, Illinois

BCR Sample No. 2651

Fraction	Weight Percent		Chemical Analysis, Dry Basis Weight Percent	
			Ash	Total Sulfur
Table No. 14				
Zone A	29.9		8.03	2.30
Zone B	28.4		7.96	2.24
Zone C	34.7		11.7	2.79
Zone D	4.4		62.1	12.9
Zone E		2.6	68.7	21.1
Table No. 15-S (30 Mesh x 0)				
Zone A	0.08		55.1	12.7
Zone B	0.19		55.6	12.4
Zone C	0.30		49.0	10.6
Zone D		1.59	71.2	17.0
Zone E	0.44		65.8	45.2
Table No. 15-S (60 Mesh x 0)				
Zone A	0.29		70.6	11.4
Zone B	0.51		69.8	12.2
Zone C	0.20		70.8	10.6
Zone D	0.43		71.2	18.9
Zone E	0.16		65.2	47.7
Composite of Fractions	100.0		13.2	3.40
Analysis of Feed Coal			13.4	3.45

A

TABLE B-73

Evaluation of Coal Cleaning Processes and Tech
for Removing Pyritic Sulfur from Fine Coa

Concentrating Table Tests--3/8 Inch x 0 Rough Cl

Ash Characteristics

Coal Identification Illinois No. 6 Seam, Franklin County, Illinois

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

BO

Table Products	Product Weight Percent	Float and Sink Weight %	Chemical Analysis, Dry Basis, Weight Percent							A Reducing Atmosph		
			Moisture	Ash	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Btu/lb	IDT	ST,S	ST,H
Zone A	29.9		0.92	8.03	2.30	0.00	1.39	0.91	13,206	2050	2360	
Zone B	28.4		1.07	7.96	2.24	0.02	1.29	0.93	13,242	2115	2395	
Zone C			1.34	11.0	2.70	0.01	1.81	0.88	12,754	2020	2160	
1.60 Float	32.0	92.1	1.92	8.94	2.42	0.01	1.56	0.86	13,098	2085	2305	
1.60 by 1.90	1.9	5.5	2.26	37.5	5.00	0.06	4.42	0.52	8,461	2030	2160	
1.90 Sink	0.8	2.4	0.79	59.5	12.C	0.14	11.6	0.28	4,262	1920	2030	
Composite	34.7	100.0		11.7	2.79	0.01	1.96	0.82	12,631			
Zone D			0.92	63.4	12.9	0.18	12.4	0.30	4,158	[illegible]	1975	
1.90 Float	0.8	19.4	1.84	36.6	6.98	0.12	6.26	0.60	8,564	[illegible]	2030	
1.90 by 2.95	3.1	69.6	1.96	69.0	10.3	0.16	9.90	0.24	3,115	1990	2110	
2.95 Sink	0.5	11.0	1.01	63.2	39.6	0.43	38.8	0.38	3,122	2340	2390	
Composite	4.4	100.0		62.1	12.9	0.18	12.4	0.32	4,173			
Zone E			0.59	69.6	20.7	0.24	20.2	0.22	2,600	1880	1900	
2.95 Float	1.7	63.7	1.18	71.6	9.22	0.17	8.93	0.12	1,982	2030	2160	
2.95 Sink	0.9	36.3	0.64	63.6	41.9	0.36	41.2	0.38	2,948	2435	2440	
Composite	2.6	100.0		68.7	21.1	0.24	20.6	0.21	2,333			
Composite of Table Products	100.0			13.2	3.40	0.02	2.54	0.84	12,337			
Analysis of Feed to Table			1.16	13.4	3.45	0.04	2.56	0.85	12,384	1960	2040	

Run Date: 9-3-70

IDT - Init
ST,S - Soft
ST,H - Soft
FT - Flui

TABLE B-73

B

f Coal Cleaning Processes and Techniques
oving Pyritic Sulfur from Fine Coal

Table Tests--3/8 Inch x 0 Rough Cleaning

Ash Characteristics

Seam, Franklin County, Illinois

e Coal Crushed to 3/8 Inch x 0

BCR Sample No. 2651

Basis,		Ash Fusibility								Ash Spectrography							
		Reducing Atmosphere				Oxidizing Atmosphere											
Organic Sulfur	Btu/lb	IDT	ST,S	ST,H	FT	IDT	ST,S	ST,H	FT	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	TiO_2	Na_2O	K_2O
0.91	13,206	2050	2360		2640	2395	2495		2660	53.0	23.3	14.2	0.84	3.32	1.12	0.86	3.1
0.93	13,242	2115	2395		2720	2480	2575		2740	55.5	21.5	11.7	0.79	1.70	1.25	1.00	2.0
0.88	12,754	2020	2160		2635	2360	2490		2640	49.5	20.0	14.5	0.75	3.05	1.04	0.83	2.8
0.86	13,098	2085	2305		2675	2490	2560		2690	53.0	21.7	15.5	0.86	2.00	1.34	0.68	3.0
0.52	8,461	2030	2160		2600	2320	2385		2590	51.0	20.0	15.7	0.75	5.35	0.88	0.26	1.9
0.28	4,262	1920	2030		2260	2285	2340		2480	32.0	15.0	26.0	0.58	15.3	0.60	0.16	0.7
0.82	12,631																
0.30	4,158	1950	1975		2425	2325	2400		2560	43.5	16.0	26.5	0.69	5.00	0.84	0.47	2.2
0.60	8,564	1970	2030		2400	2320	2375		2560	45.0	18.0	22.2	0.69	6.00	0.82	0.42	2.3
0.24	3,115	1990	2110		2460	2315	2375		2590	47.0	18.3	18.5	0.79	6.30	0.84	0.43	2.5
0.38	3,122	2340	2390		2400	2750+	2750+		2750+	11.2*	4.40*	80.0*	0.33	1.22	0.27	0.07	0.2
0.32	4,173																
0.22	2,600	1880	1900		2175	2340	2460		2590	27.5	10.8	34.5	0.48	10.7	0.58	0.24	0.9
0.12	1,982	2030	2160		2445	2220	2260		2480	40.0	14.5	14.8	0.66	14.4	0.57	0.34	1.6
0.38	2,948	2435	2440		2445	2750+	2750+		2750+	10.0*	3.65*	83.0*	0.31	1.05	0.16	0.04	0.2
0.21	2,333																
0.84	12,337																
0.85	12,384	1960	2040		2480	2330	2420		2580	48.0	19.7	21.0	0.70	5.05	0.91	0.69	2.7

IDT - Initial Deformation Temperature
ST,S - Softening Temperature, Spherical
ST,H - Softening Temperature, Hemispherical
FT - Fluid Temperature

* Extrapolated Values

TABLE B-74

SCREEN ANALYSIS

Coal Identification Ohio No. 5 Seam, Muskingum County, Ohio

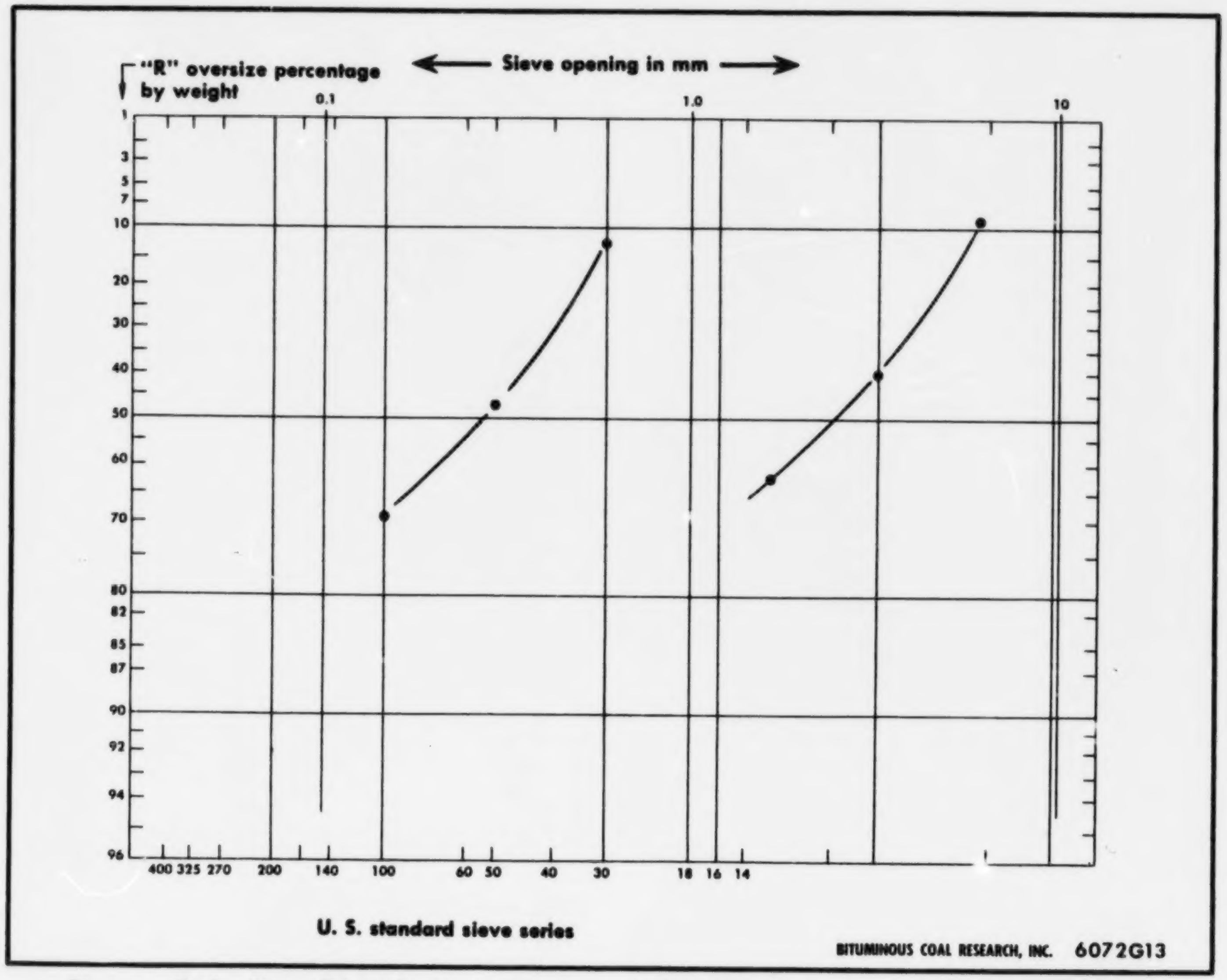
BCR Sample No. 2694

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

Screen Size	Weight Percent	Cumulative
plus 1/4 in.	8.6	8.6
1/4 in. x 6 M	30.0	38.6
6 M x 12 M	23.8	62.4
minus 12 M	37.6	100.0
Total	100.0	

Zones A, B and C from 3/8 Inch x 0 Run (11-18-70) Crushed to 30 Mesh x 0

Screen Size	Weight Percent	Cumulative
plus 30 M	7.5	7.5
30 M x 50 M	23.3	30.8
50 M x 100 M	21.1	51.9
minus 100 M	48.1	100.0
Total	100.0	



BITUMINOUS COAL RESEARCH, INC. 6072G13

Figure B-8. Size Distribution Curves of 30 Mesh X 0 and 3/8 Inch X 0 Concentrating Table Feeds for Ohio No. 5 Seam, Muskingum County, Ohio, BCR Sample No. 2694

TABLE B-75

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--3/8 Inch x 0 Rough Cleaning and Pyrite Precleaning

Coal Identification Ohio No. 5 Seam, Muskingum County, Ohio

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

BCR Sample No. 2694

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	37.2		1.06	8.64	3.33	
Zone B	39.7		1.27	7.55	3.32	
Zone C						
Float at 1.60	11.3	69.8	1.36	10.3	4.76	
1.60 by 1.90	2.0	12.4	1.14	25.0	12.6	
Sink at 1.90	2.9	17.8	0.82	48.9	26.2	
Composite	16.2	100.0		19.0	9.55	
Zone D						
Float at 1.90	0.2	5.2	1.14	22.5	13.8	
1.90 by 2.95	2.0	46.2	1.46	54.6	22.9	
Sink at 2.95	2.1	48.6	0.70	60.4	43.5	
Composite	4.3	100.0		55.7	32.4	
Zone E						
Float at 2.95	0.3	12.8	0.52	70.0	18.8	
Sink at 2.95	2.3	87.2	0.22	63.0	45.4	
Composite	2.6	100.0		63.9	42.0	
Composite of Zones A, B, C	93.1			9.98	4.41	
Composite of 1.60 Float Fractions	88.2			8.36	3.51	
Composite of 2.95 Sink Fractions	4.5			61.8	44.5	
Composite of Table Products	100.0			13.3	6.59	
Analysis of Feed to Table			2.67	14.0	6.88	

Run Date: 11-18-70

TABLE B-76

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--30 Mesh x 0 Deep Cleaning

Coal Identification Ohio No. 5 Seam, Muskingum County, Ohio

Zones A, B, and C, 3/8 Inch x 0 Run (11-18-70) Crushed to 30 Mesh x 0

BCR Sample No. 2694

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	76.0		0.66	7.12	3.23	
Zone B	15.5		0.47	8.33	3.40	
Zone C						
Float at 1.60	0.7	85.8	1.09	15.6	5.47	
Sink at 1.60	0.1	14.2	0.78	47.8	24.7	
Composite	0.8	100.0		20.2	8.20	
Zone D						
Float at 1.60	1.0	35.4	0.91	21.0	7.72	
1.60 by 2.95	1.7	58.0	0.62	37.9	17.4	
Sink at 2.95	0.2	6.6	0.22	63.0	46.2	
Composite	2.9	100.0		33.6	15.9	
Zone E						
Float at 2.95	0.6	13.0	0.66	60.6	19.6	
Sink at 2.95	4.2	87.0	0.13	63.9	40.2	
Composite	4.8	100.0		63.5	37.5	
Composite of Zones A, B, C	92.3			7.44	3.30	
Composite of 1.60 Float Fractions	93.2			7.54	3.33	
Composite of 2.95 Sink Fractions	4.4			63.9	40.5	
Composite of Table Products	100.0			10.9	5.31	
Analysis of Feed to Table			0.86	9.02	4.30	

Run Date: 12-7-70

TABLE B-77

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests-- Effects of Two-stage Cleaning

Coal Identification Ohio No. 5 Seam, Muskingum County, Ohio

Composite of 3/8 Inch x 0 Run (11-18-70) and 30 Mesh x 0 Run

BCR Sample No. 2694

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	70.8			7.12	3.23	
Zone B	14.4			8.33	3.40	
Zone C						
Float at 1.60	0.6	85.8		15.6	5.47	
Sink at 1.60	0.1	14.2		47.8	24.7	
Composite	0.7	100.0		20.2	8.20	
Zone D						
Float at 2.95	4.7	67.1		40.7	17.6	
Sink at 2.95	2.3	32.9		60.6	43.7	
Composite	7.0	100.0		47.2	26.2	
Zone E						
Float at 2.95	0.9	12.7		63.7	19.3	
Sink at 2.95	6.2	87.2		63.6	42.1	
Composite	7.1	100.0		63.6	40.0	
Composite of Zones A, B, C	85.9			7.43	3.30	
Composite of 1.60 Float Fractions	85.8			7.38	3.27	
Composite of 2.95 Sink Fractions	8.5			62.8	42.5	
Composite of Table Products	100.0			14.2	7.51	
Analysis of Feed to Table				14.0	6.88	

TABLE B-78

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table No. 15-S Tests - Pyrite Beneficiation

Coal Identification Ohio No. 5 Seam, Muskingum County, Ohio

Zone E, 3/8 Inch x 0 Run (11-18-70) Crushed to 30 Mesh x 0

BCR Sample No. 2694

Table Products	Product, Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
		Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	1.2	0.60	52.3	29.9	
Zone B	8.5	0.60	49.4	27.4	
Zone C	41.2	0.20	65.5	37.0	
Zone D	38.4	0.10	65.1	41.2	
Zone E	10.7	0.08	65.0	40.7	
Composite of Table Products	100.0		63.8	38.1	
Analysis of Feed to Table		0.23	63.9	41.3	

Run Date: 11-24-70

TABLE B-79

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Pyrite Beneficiation - Effects of Two-stage Cleaning

Coal Identification Ohio No. 5 Seam, Muskingum County, Ohio

BCR Sample No. 2694

Pyrite Precleaning

Concentrating Table No. 14 Test Run Date 11-18-70

Feed to Concentrating Table: Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	14.0	6.88
Zone E (Pyrite Zone)	2.6	63.9	42.0

Pyrite Cleaning

Concentrating Table No. 15-S Test Run Date 11-24-70

Feed to Concentrating Table: Zone E, 3/8 Inch x 0 Run (11-18-70) Crushed to 30 Mesh x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	63.9	41.3
Zone E (Pyrite Zone)	10.7	65.0	40.7

Concentrating Table No. 15-S Test Run Date Process Deferred

Feed to Concentrating Table: Zone D, 30 Mesh x 0 Run (11-24-70) Crushed to 60 Mesh x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table			
Zone E (Pyrite Zone)			

Two Stage Pyrite Product			

TABLE B-80

Flowsheet for Pyrite Beneficiation Tests

Ohio No. 5 Seam, Muskingum County, Ohio
BCR Sample No. 2694

Basis:
Pounds of Total Sulfur/Tons of
Run-of-Mine Coal

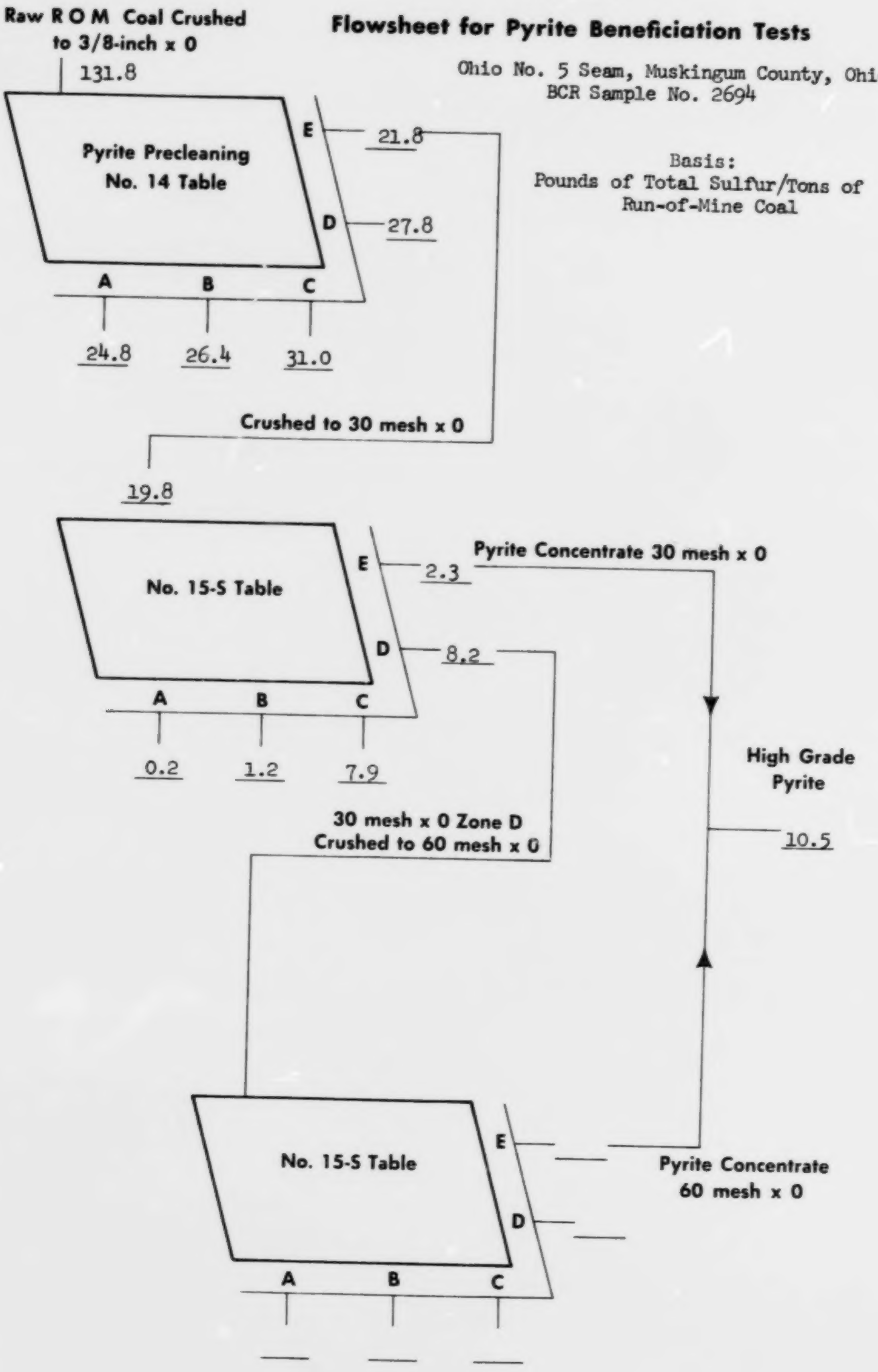

Raw R O M Coal Crushed to 3/8-inch x 0
131.8
Pyrite Precleaning No. 14 Table
E
21.8
D
27.8
A
B
C
24.8
26.4
31.0
Crushed to 30 mesh x 0
19.8
No. 15-S Table
E
2.3
Pyrite Concentrate 30 mesh x 0
D
8.2
A
B
C
0.2
1.2
7.9
High Grade Pyrite
10.5
30 mesh x 0 Zone D Crushed to 60 mesh x 0
No. 15-S Table
E
D
Pyrite Concentrate 60 mesh x 0
A
B
C

TABLE B-81

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Flowsheet Data for Pyrite Beneficiation Tests

Coal Identification Ohio No. 5 Seam, Muskingum County, Ohio

BCR Sample No. 2694

Fraction	Weight Percent		Chemical Analysis, Dry Basis Weight Percent	
			Ash	Total Sulfur
Table No. 14				
Zone A	37.2		8.64	3.33
Zone B	39.7		7.55	3.32
Zone C	16.2		19.0	9.55
Zone D	4.3		55.7	32.4
Zone E		2.6	63.9	42.0
Table No. 15-S (30 Mesh x 0)				
Zone A	0.03		52.3	29.9
Zone B	0.22		49.4	27.4
Zone C	1.07		65.5	37.0
Zone D	1.00		65.1	41.2
Zone E	0.28		65.0	40.7
Table No. 15-S (60 Mesh x 0)				
Zone A				
Zone B				
Zone C				
Zone D				
Zone E				
Composite of Fractions			13.3	6.59
Analysis of Feed Coal			14.0	6.88

TABLE B-82

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Pyrite Beneficiation - Effects of Two-stage Cleaning

Coal Identification Ohio No. 5 Seam, Muskingum County, Ohio

BCR Sample No. 2694

Pyrite Precleaning

Concentrating Table No. 14 Test Run Date 11-18-70

Feed to Concentrating Table: Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table	100.0	14.0	6.88
Zone E (Pyrite Zone)	2.6	63.9	42.0

Pyrite Cleaning

Concentrating Table No. 15-S Test Run Date Process Deferred

Feed to Concentrating Table:

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table			
Zone E (Pyrite Zone)			

Concentrating Table No. 15-S Test Run Date Process Deferred

Feed to Concentrating Table:

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %	
		Ash	Total Sulfur
Analysis of Feed to Table			
Zone E (Pyrite Zone)			

Two Stage Pyrite Product			

TABLE B-83

Flowsheet for Pyrite Beneficiation Tests

Ohio No. 5 Seam, Muskingum County, Ohio
BCR Sample No. 2694

Basis:
Pounds of Total Sulfur/Ton of ROM Coal

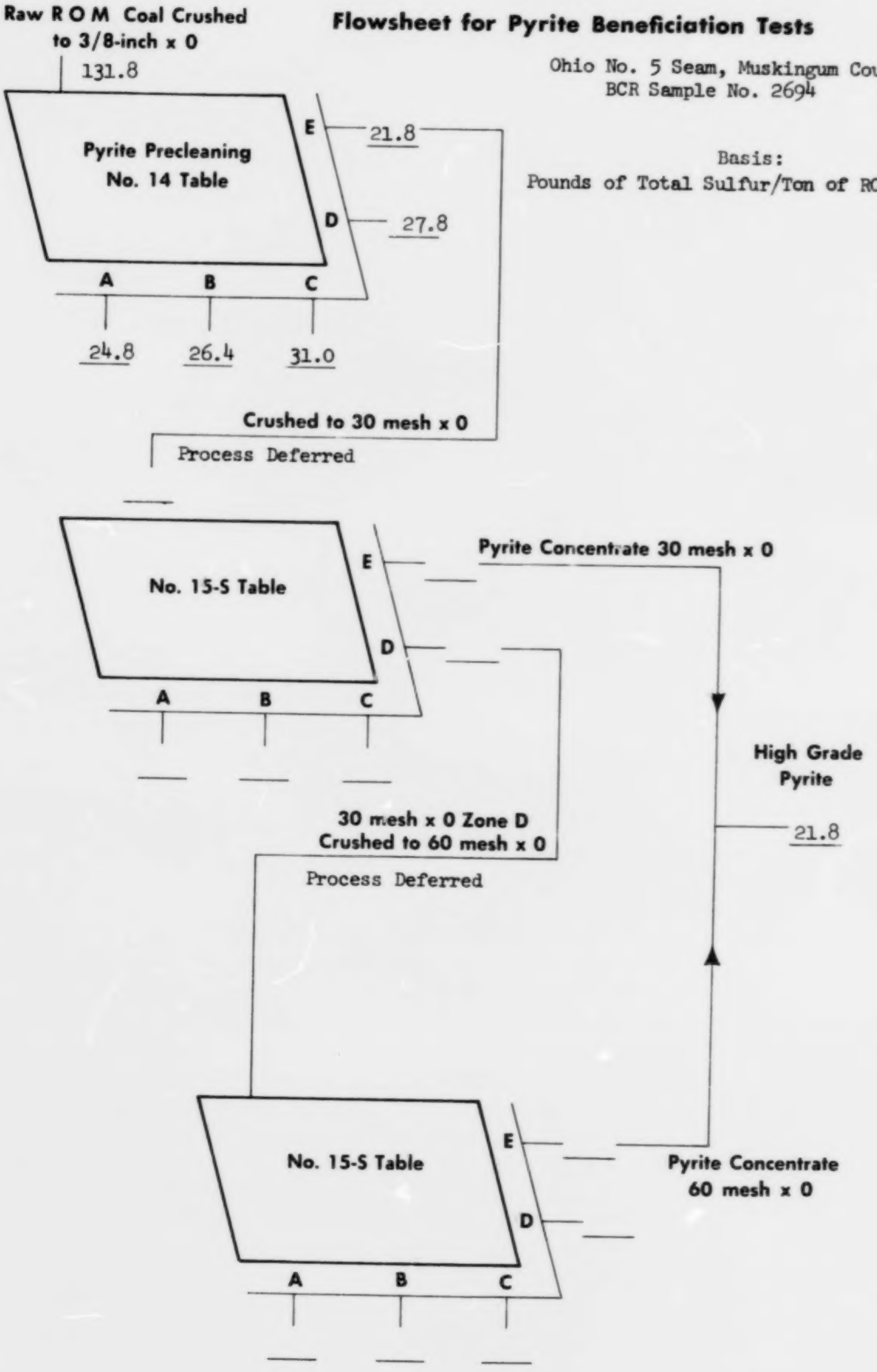

Raw R O M Coal Crushed
to 3/8-inch x 0
131.8
Pyrite Precleaning
No. 14 Table
E
21.8
D
27.8
A
B
C
24.8
26.4
31.0
Crushed to 30 mesh x 0
Process Deferred
No. 15-S Table
E
D
A
B
C
Pyrite Concentrate 30 mesh x 0
High Grade
Pyrite
21.8
30 mesh x 0 Zone D
Crushed to 60 mesh x 0
Process Deferred
No. 15-S Table
E
D
A
B
C
Pyrite Concentrate
60 mesh x 0

TABLE B-84

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Flowsheet Data for Pyrite Beneficiation Tests

Coal Identification Ohio No. 5 Seam, Muskingum County, Chio

BCR Sample No. 2694

Fraction	Weight Percent		Chemical Analysis, Dry Basis Weight Percent	
			Ash	Total Sulfur
Table No. 14				
Zone A	37.2		8.64	3.33
Zone B	39.7		7.55	3.32
Zone C	16.2		19.0	9.55
Zone D	4.3		55.7	32.4
Zone E	2.6		63.9	42.0
Table No. 15-S (30 Mesh x 0)				
Zone A	Process	Deferred		
Zone B				
Zone C				
Zone D				
Zone E				
Table No. 15-S (60 Mesh x 0)				
Zone A	Process	Deferred		
Zone B				
Zone C				
Zone D				
Zone E				
Composite of Fractions	100.0		13.3	6.59
Analysis of Feed Coal			14.0	6.88

A

TABLE B-85

Evaluation of Coal Cleaning Processes and Techni
for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--3/8 Inch x 0 Rough Clea

Ash Characteristics

Coal Identification Ohio No. 5 Seam, Muskingum County, Ohio

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

BCR

			Chemical Analysis, Dry Basis, Weight Percent							As Reducing Atmospher		
Table Products	**Product Weight Percent**	**Float and Sink Weight %**	**Moisture**	**Ash**	**Total Sulfur**	**Sulfate Sulfur**	**Pyritic Sulfur**	**Organic Sulfur**	**Btu/lb**	**IDT**	**ST,S**	**ST,H**
Zone A	37.2		1.06	8.64	3.33	0.04	2.77	0.52	13,114	1900	1960	
Zone B	39.7		1.27	7.55	3.32	0.04	2.74	0.54	13,264	1925	1980	
Zone C			0.80	18.7	9.44	0.06	8.81	0.57	11,343	2030	2060	
1.60 Float	11.3	69.8	1.36	10.3	4.76	0.04	4.25	0.47	12,634	1970	2010	
1.60 by 1.90	2.0	12.4	1.14	25.0	12.6	0.12	12.1	0.36	9,844	2070	2080	
1.90 Sink	2.9	17.8	0.82	48.9	26.2	0.19	25.6	0.30	5,579	2055	2070	
Composite	16.2	100.0		19.0	9.55	0.08	9.02	0.43	10,323			
Zone D			0.38	56.7	32.7	0.17	32.0	0.56	4,721	2070	2080	
1.90 Float	0.2	5.2	1.14	22.5	13.8	0.10	13.3	0.43	10,526	2080	2200	
1.90 by 2.95	2.0	46.2	1.46	54.6	22.9	0.30	22.4	0.22	5,148	2015	2030	
2.95 Sink	2.1	48.6	0.70	60.4	43.5	0.17	43.1	0.27	3,154	2415	2430	
Composite	4.3	100.0		55.7	32.4	0.23	32.0	0.26	4,459			
Zone E			0.22	64.2	41.7	0.14	40.9	0.62	3,034	2315	2330	
2.95 Float	0.3	12.8	0.52	70.0	18.8	0.14	18.4	0.22	3,370	1980	2000	
2.95 Sink	2.3	87.2	0.22	63.6	45.4	0.12	44.9	0.42	2,802	2440	2445	
Composite	2.6	100.0		63.9	42.0	0.12	41.5	0.39	2,875			
Composite of Table Products	100.0			13.3	6.59	0.06	6.03	0.50	12,083			
Analysis of Feed to Table			2.67	14.0	6.88	0.24	6.04	0.60	12,146	2010	2035	

Run Date: 11-18-70

IDT - Initi
ST,S - Softe
ST,H - Softe
FT - Fluid

B

TABLE B-85

of Coal Cleaning Processes and Techniques
moving Pyritic Sulfur from Fine Coal

Table Tests--3/8 Inch x 0 Rough Cleaning

Ash Characteristics

Seam, Muskingum County, Ohio

ne Coal Crushed to 3/8 Inch x 0

BCR Sample No. 2694

Basis,		Ash Fusibility								Ash Spectrography							
		Reducing Atmosphere				Oxidizing Atmosphere											
Organic Sulfur	Btu/lb	IDT	ST,S	ST,H	FT	IDT	ST,S	ST,H	FT	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	TiO_2	Na_2O	K_2O
0.52	13,114	1900	1960		2495	2525	2555		2580	37.0	21.3	38.0	0.41	1.34	0.80	0.20	1.3
0.54	13,264	1925	1980		2530	2520	2560		2585	30.5	22.3	43.5	0.3	1.40	0.80	0.11	0.7
0.57	11,343	2030	2060		2395	2545	2750$^+$		2750$^+$	21.0	13.3	62.0*	0.3	0.56	0.41	0.06	0.5
0.47	12,634	1970	2010		2570	2520	2560		2595	28.0	20.5	48.0*	0.3	1.15	0.66	0.06	0.9
0.36	9,844	2070	2080		2180	2620	2750$^+$		2750$^+$	20.0	12.8	63.0*	0.3	0.49	0.40	0.03	0.9
0.30	5,579	2055	2070		2160	2600	2655		2750	19.2	7.50	69.0*	0.3	0.41	0.25	0.06	0.5
0.43	10,323																
0.56	4,721	2070	2080		2230	2630	2660		2750$^+$	15.0	5.50	77.0*	0.3	0.41	0.16	0.02	0.3
0.43	10,526	2080	2200		2560	2640	2750$^+$		2750$^+$	13.2*	8.90	75.0*	0.3	0.49	0.25	0.04	1.6
0.22	5,148	2015	2030		2140	2600	2615		2620	57.0	4.65	36.0	0.3	0.46	0.24	0.08	0.8
0.27	3,154	2415	2430		2440	2750$^+$	2750$^+$		2750$^+$	10.0*	3.20*	85.0*	0.3	0.30	0.05	0.02	0.1
0.26	4,459																
0.62	3,034	2315	2330		2360	2645	2750$^+$		2750$^+$	11.5*	3.05	84.0*	0.3	0.31	0.07*	0.02	0.1
0.22	3,370	1980	2000		2555	2600	2680		2745	31.5	11.2	54.0*	0.3	0.79	0.38	0.14	1.2
0.42	2,802	2440	2445		2450	2750$^+$	2750$^+$		2750$^+$	45.5	22.1	29.5	0.52	0.56	0.85	0.02	0.1
0.39	2,875																
0.50	12,083																
0.60	12,146	2010	2035		2240	2560	2645		2700	25.5	15.4	55.0*	0.32	0.96	0.54	0.14	1.5

IDT - Initial Deformation Temperature
ST,S - Softening Temperature, Spherical
ST,H - Softening Temperature, Hemispherical
FT - Fluid Temperature

* Extrapolated Values

TABLE B-86

SCREEN ANALYSIS

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

BCR Sample No. 2713

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

Screen Size	Weight Percent	Cumulative
plus 1/4 in.	9.1	9.1
1/4 in. x 6 M	27.8	36.9
6 M x 12 M	22.5	59.4
minus 12 M	40.6	100.0
Total	100.0	

Zones A, B and C from 3/8 Inch x 0 Run (1-6-71) Crushed to 30 Mesh x 0

Screen Size	Weight Percent	Cumulative
plus 30 M	10.7	10.7
30 M x 50 M	35.9	46.6
50 M x 100 M	23.2	69.8
minus 100 M	30.2	100.0
Total	100.0	

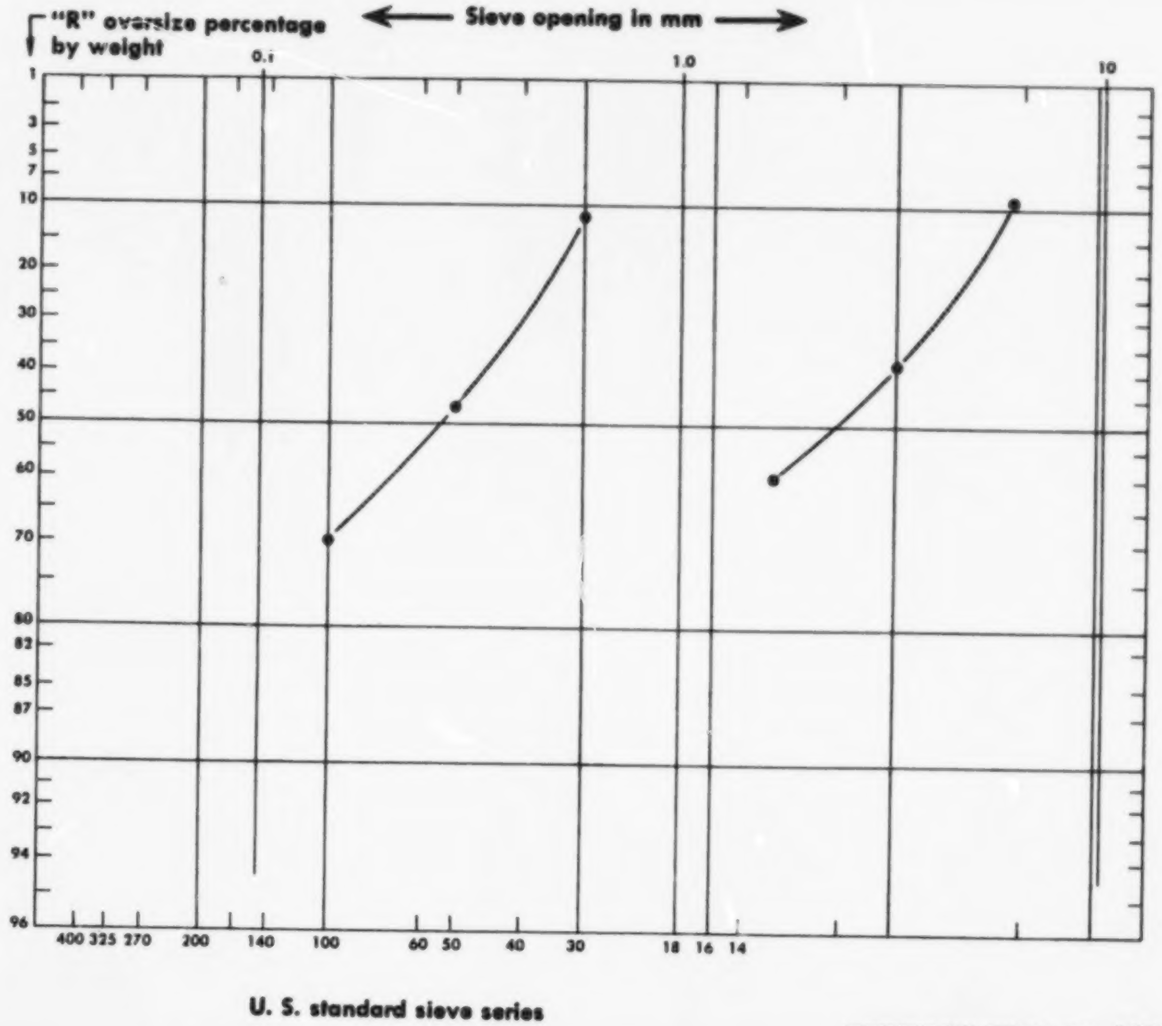


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Figure B-9. Size Distribution Curves of 30 Mesh X 0 and 3/8 Inch X 0 Concentrating Table Feeds for Upper Freeport Seam, Armstrong County, Pennsylvania, BCR Sample No. 2713

TABLE B-87

Evaluation of Coal Cleaning Processes and Techniques
for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--3/8 Inch x 0 Rough Cleaning

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

BCR Sample No. 2713

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	53.5		0.53	9.44	1.06	
Zone B	21.7		0.45	12.5	1.09	
Zone C			0.66	46.6	1.80	
Float at 1.60	2.6	24.4	0.64	20.0	1.49	
1.60 by 1.90	4.1	39.3	0.69	45.8	1.76	
Sink at 1.90	3.8	36.3	0.86	66.8	2.27	
Composite	10.5	100.0		47.1	1.88	
Zone D			0.88	73.8	3.31	
Float at 1.90	1.1	10.1	0.69	44.5	1.92	
1.90 by 2.95	9.4	87.9	0.78	78.1	2.39	
Sink at 2.95	0.2	2.0	0.24	60.1	39.6	
Composite	10.7	100.0		74.3	3.09	
Zone E			0.52	75.6	13.8	
Float at 2.95	2.6	72.9	0.54	81.0	4.11	
Sink at 2.95	1.0	27.1	0.18	60.6	42.1	
Composite	3.6	100.0		75.5	14.4	
Composite of Zones A, B, C	85.7			14.8	1.17	
Composite of 1.60 Float Fractions	77.8			10.6	1.08	
Composite of 2.95 Sink Fractions	1.2			60.5	41.7	
Composite of Table Products	100.0			23.4	1.85	
Analysis of Feed to Table			0.71	23.1	1.86	

Run Date: 1-6-71

TABLE B-88

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--30 Mesh x 0 Deep Cleaning

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

Zones A, B, and C, 3/8 Inch x 0 Run (1-6-71) Crushed to 30 Mesh x 0

BCR Sample No. 2713

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	78.2		0.58	10.2	1.00	
Zone B	11.8		0.52	15.0	1.06	
Zone C						
Float at 1.60	0.8	62.7	0.60	23.8	1.18	
Sink at 1.60	0.5	37.3	0.64	48.0	1.86	
Composite	1.3	100.0		32.8	1.43	
Zone D						
Float at 1.60	0.58	7.5	0.61	31.2	1.76	
1.60 by 2.95	7.18	92.0	0.96	58.1	1.61	
Sink at 2.95	0.04	0.5	0.25	63.6	37.4	
Composite	7.80	100.0		56.1	1.80	
Zone E						
Float at 2.95	0.4	49.6	0.75	73.6	9.51	
Sink at 2.95	0.5	50.4	0.16	61.6	43.2	
Composite	0.9	100.0		67.6	26.5	
Composite of Zones A, B, C	91.3			11.1	1.01	
Composite of 1.60 Float Fractions	91.38			11.1	1.01	
Composite of 2.95 Sink Fractions	0.54			61.7	42.8	
Composite of Table Products	100.0			15.2	1.30	
Analysis of Feed to Table			0.57	14.2	1.24	

Run Date: 1-14-71

TABLE B-89

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table Tests--Effects of Two-stage Cleaning

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

Composite of 3/8 Inch x 0 Run (1-6-71) and 30 Mesh x 0 Run (1-14-71)

BCR Sample No. 2713

Table Products	Product Weight Percent	Float and Sink Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
			Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	67.0			10.2	1.00	
Zone B	10.1			15.0	1.06	
Zone C						
Float at 1.60	0.7	62.7		23.8	1.18	
Sink at 1.60	0.4	37.3		48.0	1.86	
Composite	1.1	100.0		32.8	1.43	
Zone D						
Float at 2.95	17.16	98.6		67.4	2.07	
Sink at 2.95	0.24	1.4		60.7	39.2	
Composite	17.4	100.0		67.3	2.10	
Zone E						
Float at 2.95	2.96	67.3		80.1	4.77	
Sink at 2.95	1.44	32.7		60.9	42.4	
Composite	4.4	100.0		73.8	17.1	
Composite of Zones A, B, C	78.2			11.1	1.01	
Composite of 1.60 Float Fractions	77.8			11.0	1.01	
Composite of 2.95 Sink Fractions	1.64			60.9	41.9	
Composite of Table Products	100.0			23.7	1.91	
Analysis of Feed to Table				23.1	1.86	

TABLE B-90

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table No. 15-S Tests - Pyrite Beneficiation

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

Zone E, 3/8 Inch x 0 Run (1-6-71) Crushed to 30 Mesh x 0

BCR Sample No. 2713

Table Products	Product, Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
		Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	2.0	0.66	70.8	8.66	
Zone B	26.1	0.70	78.0	3.02	
Zone C	12.9	0.60	71.4	8.30	
Zone D	48.9	0.43	79.0	14.8	
Zone E	10.1	0.08	63.8	46.8	
Composite of Table Products	100.0		76.1	14.0	
Analysis of Feed to Table		0.96	76.0	14.2	

Run Date: 1-19-71

TABLE B-91

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Concentrating Table No. 15-S Tests - Pyrite Beneficiation

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

Zone D, 30 Mesh x 0 Run (1-19-71) Crushed to 60 Mesh x 0

BCR Sample No. 2713

Table Products	Product, Weight Percent	Chemical Analysis, Dry Basis, Weight Percent			
		Moisture	Ash	Total Sulfur	Ultimate Carbon
Zone A	6.4	0.58	79.4	10.8	
Zone B	34.7	0.47	79.6	10.2	
Zone C	24.1	0.44	80.4	9.04	
Zone D	21.4	0.49	84.2	7.90	
Zone E	13.4	0.08	66.2	44.2	
Composite of Table Products	100.0		79.0	14.0	
Analysis of Feed to Table		0.43	79.0	14.4	

Run Date: 1-26-71

TABLE B-92

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Pyrite Beneficiation - Effects of Two-stage Cleaning

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

BCR Sample No. 2713

Pyrite Precleaning

Concentrating Table No. 14 Test Run Date 1-6-71
Feed to Concentrating Table: Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %: Ash	Chemical Analysis, Dry Basis, Weight %: Total Sulfur
Analysis of Feed to Table	100.0	23.1	1.86
Zone E (Pyrite Zone)	3.6	75.5	14.4

Pyrite Cleaning

Concentrating Table No. 15-S Test Run Date 1-19-71
Feed to Concentrating Table: Zone E, 3/8 Inch x 0 Run (1-6-71) Crushed to 30 Mesh x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %: Ash	Chemical Analysis, Dry Basis, Weight %: Total Sulfur
Analysis of Feed to Table	100.0	76.0	14.2
Zone E (Pyrite Zone)	10.1	63.1	46.8

Concentrating Table No. 15-S Test Run Date 1-26-71
Feed to Concentrating Table: Zone D, 30 Mesh x 0 Run (1-19-71) Crushed to 60 Mesh x 0

	Product, Weight %	Chemical Analysis, Dry Basis, Weight %: Ash	Chemical Analysis, Dry Basis, Weight %: Total Sulfur
Analysis of Feed to Table	100.0	79.0	14.0
Zone E (Pyrite Zone)	13.4	66.2	44.2

Two Stage Pyrite Product	0.60	64.8	45.8

TABLE B-93

Flowsheet for Pyrite Beneficiation Tests

Upper Freeport Seam, Armstrong County,
Pennsylvania
BCR Sample No. 2713

Basis:
Pounds of Total Sulfur/Ton of
Run-of-Mine Coal

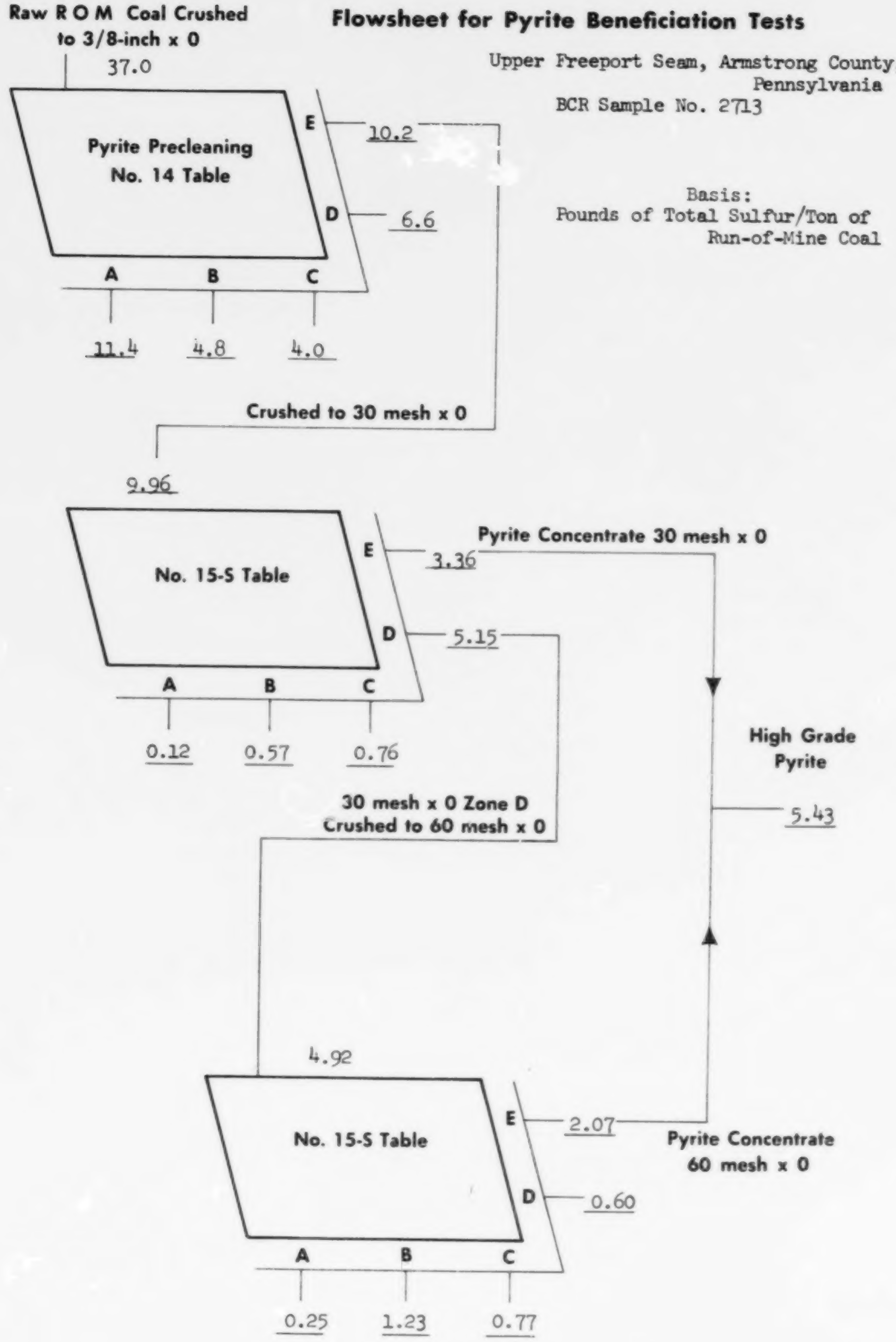
Raw R O M Coal Crushed to 3/8-inch x 0
37.0
Pyrite Precleaning No. 14 Table
E
10.2
D
6.6
A
B
C
11.4
4.8
4.0
Crushed to 30 mesh x 0
9.96
No. 15-S Table
E
3.36
Pyrite Concentrate 30 mesh x 0
D
5.15
A
B
C
0.12
0.57
0.76
High Grade Pyrite
5.43
30 mesh x 0 Zone D Crushed to 60 mesh x 0
4.92
No. 15-S Table
E
2.07
Pyrite Concentrate 60 mesh x 0
D
0.60
A
B
C
0.25
1.23
0.77

TABLE B-94

Evaluation of Coal Cleaning Processes and Techniques for Removing Pyritic Sulfur from Fine Coal

Flowsheet Data for Pyrite Beneficiation Tests, Phase IV

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

BCR Sample No. 2713

Fraction	Weight Percent		Chemical Analysis, Dry Basis Weight Percent	
			Ash	Total Sulfur
Table No. 14				
Zone A	53.5		9.44	1.06
Zone B	21.7		12.5	1.09
Zone C	10.5		47.1	1.88
Zone D	10.7		74.3	3.09
Zone E		3.6	75.5	14.4
Table No. 15-S (30 Mesh x 0)				
Zone A	0.07		70.8	8.66
Zone B	0.94		78.0	3.02
Zone C	0.47		71.4	8.30
Zone D		1.76	79.0	14.8
Zone E	0.36		63.8	46.8
Table No. 15-S (60 Mesh x 0)				
Zone A	0.11		79.4	10.8
Zone B	0.61		79.6	10.2
Zone C	0.42		80.4	9.04
Zone D	0.38		84.2	7.90
Zone E	0.24		66.2	44.2
Composite of Fractions	100.0		23.4	1.85
Analysis of Feed Coal			23.1	1.86

A

TABLE B-95

Evaluation of Coal Cleaning Processes and Tech
for Removing Pyritic Sulfur from Fine Coa

Concentrating Table Tests--3/8 Inch x 0 Rough Cl

Ash Characteristics

Coal Identification Upper Freeport Seam, Armstrong County, Pennsyl

Raw Run-of-Mine Coal Crushed to 3/8 Inch x 0

BC

Table Products	Product Weight Percent	Float and Sink Weight %	Chemical Analysis, Dry Basis, Weight Percent							Reducing Atmosphe		
			Moisture	Ash	Total Sulfur	Sulfate Sulfur	Pyritic Sulfur	Organic Sulfur	Btu/lb	IDT	ST,S	ST,H
Zone A	53.5		0.53	9.44	1.06	--	0.52	0.54	13,881	2740	2750^{+}	
Zone B	21.7		0.45	12.5	1.09	--	0.53	0.56	13,332	2750^{+}	2750^{+}	
Zone C			0.66	46.6	1.80	.01	1.47	0.32	7,534	2750^{+}	2750^{+}	
1.60 Float	2.6	24.4	0.64	20.0	1.49	--	0.90	0.59	12,050	2750^{+}	2750^{+}	
1.60 by 1.90	4.1	39.3	0.69	45.8	1.76	--	1.40	0.36	7,664	2750^{+}	2750^{+}	
1.90 Sink	3.8	36.3	0.86	66.8	2.27	--	2.05	0.22	4,077	2750^{+}	2750^{+}	
Composite	10.5	100.0		47.1	1.88	--	1.51	0.37	7,432			
Zone D			0.88	73.8	3.31	.01	3.14	0.16	2,890	2560	2750^{+}	
1.90 Float	1.1	10.1	0.69	44.5	1.92	--	1.54	0.38	7,892	2750^{+}	2750^{+}	
1.90 by 2.95	9.4	87.9	0.78	78.1	2.39	--	2.26	0.13	2,106	2635	2750^{+}	
2.95 Sink	0.2	2.0	0.24	60.1	39.6	.10	39.2	0.28	3,920	2400	2435	
Composite	10.7	100.0		74.3	3.09	--(.002)	2.93	0.16	2,727			
Zone E			0.52	75.6	13.8	.03	13.6	0.16	2,334	2075	2160	
2.95 Float	2.6	72.9	0.54	81.0	4.11	.02	3.97	0.12	1,600	2525	2720	
2.95 Sink	1.0	27.1	0.18	60.6	42.1	.06	41.8	0.28	3,624	2445	2450	
Composite	3.6	100.0		75.5	14.4	.03	14.2	0.16	2,149			
Composite of Table Products	100.0			23.4	1.85	--	1.38	0.47	11,469			
Analysis of Feed to Table			0.71	23.1	1.86	.02	1.31	0.53	11,510	2650	2750^{+}	

Run Date: 1-6-71

IDT - Init
ST,S - Soft
ST,H - Soft
FT - Flui

B

TABLE B-95

l Cleaning Processes and Techniques
Pyritic Sulfur from Fine Coal

Tests--3/8 Inch x 0 Rough Cleaning

h Characteristics

eam, Armstrong County, Pennsylvania

l Crushed to 3/8 Inch x 0

BCR Sample No. 2713

,		Ash Fusibility								Ash Spectrography							
ic		Reducing Atmosphere				Oxidizing Atmosphere											
r	Btu/lb	IDT	ST,S	ST,H	FT	IDT	ST,S	ST,H	FT	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	TiO_2	Na_2O	K_2O
4	13,881	2740	2750^+		2750^+	2750^+	2750^+		2750^+	54.0	32.0	6.20	0.72	1.35	1.25	0.26	2.0
6	13,332	2750^+	2750^+		2750^+	2750^+	2750^+		2750^+	56.0	31.6	8.00	0.71	1.05	1.42	0.30	2.9
2	7,534	2750^+	2750^+		2750^+	2750^+	2750^+		2750^+	54.0	31.6	7.10	1.26	0.56	1.25	0.39	5.1
9	12,050	2750^+	2750^+		2750^+	2750^+	2750^+		2750^+	54.0	31.5	8.50	0.80	0.66	1.45	0.35	1.2
6	7,664	2750^+	2750^+		2750^+	2750^+	2750^+		2750^+	56.0	30.5	6.00	1.03	0.59	1.20	0.34	3.0
2	4,077	2750^+	2750^+		2750^+	2750^+	2750^+		2750^+	53.0	30.5	6.80	1.42	0.59	1.25	0.42	4.7
7	7,432																
6	2,890	2560	2750^+		2750^+	2750^+	2750^+		2750^+	52.5	30.0	9.40	1.29	0.53	1.20	0.36	4.8
8	7,892	2750^+	2750^+		2750^+	2750^+	2750^+		2750^+	52.0	30.5	6.50	1.06	0.66	1.15	0.36	4.9
8	2,106	2635	2750^+		2750^+	2750^+	2750^+		2750^+	55.0	30.5	4.95	1.30	0.3	1.25	0.42	5.1
8	3,920	2400	2435		2435	2750^+	2750^+		2750^+	14.0*	3.30*	80.0*	0.3	0.3	0.10	0.02	0.1
6	2,727																
6	2,334	2075	2160		2650	2540	2575		2680	46.5	25.0	26.5	0.93	0.50	0.94	0.34	4.2
2	1,600	2525	2720		2750^+	2750^+	2750^+		2750^+	54.0	29.0	9.30	1.30	0.3	1.19	0.36	4.7
8	3,624	2445	2450		2460	2750^+	2750^+		2750^+	12.4*	2.70*	83.0*	0.3	0.3	0.08	0.02	0.1
6	2,149																
7	11,469																
8	11,510	2650	2750^+		2750^+	2750^+	2570^+		2750^+	54.0	29.5	9.30	1.02	0.74	1.15	0.32	4.6

IDT - Initial Deformation Temperature
ST,S - Softening Temperature, Spherical
ST,H - Softening Temperature, Hemispherical
FT - Fluid Temperature

* Extrapolated Values

Appendix C

FUEL AND PYRITE CONCENTRATE EVALUATIONS

TABLE C-1. POTENTIAL COMBUSTION USE OF SELECTED FRACTIONS FROM PHASE II COALS USING CONVENTIONAL THREE-SPLIT SEPARATION

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

BCR Lot No. 2546

Conventional or Low Sulfur Combustor Feedstock	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis			Available Calorific Value, Percent	Total Usable Product, Percent
		Ash	Total Sulfur	Calorific Value Btu/lb		
Zone A (assumed 1.60 Fl.)	38.6	5.99	0.92	14,478		
Zone B (assumed 1.60 Fl.)	33.3	6.53	1.06	14,366		
Zone C, 1.60 Fl.	7.4	13.1	2.30	13,222		
Composite of Fractions	79.3	6.88	1.11	14,314	93.5	90.0
High Sulfur Combustor Feedstock						
Zone C, 1.60 x 1.90	4.1	41.2	4.56	8,395		
Zone C, 1.90 Sk.	2.2	66.3	5.04	4,146		
Zone D, 1.90 Fl.	1.0	36.9	4.98	9,132		
Zone D, 2.95 Sk.	0.4	60.0	38.9	4,137		
Zone D, 2.95 Sk.	1.1	62.1	41.7	3,742		
Composite of Fractions	8.8	50.4	10.9	6,644	4.8	10.0
Refuse						
Zone D, 1.90 x 2.95	10.4	81.8	3.64	1,781		
Zone E, 2.95 Fl.	1.5	82.6	5.54	1,648		
Composite of Fractions	11.9	81.9	3.88	1,764	1.7	
Composite of Table Fractions	100.0	19.6	2.30	12,146		

TABLE C-2. POTENTIAL COMBUSTION USE OF SELECTED FRACTIONS FROM PHASE II COALS USING CONVENTIONAL TWO-SPLIT SEPARATION

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

BCR Lot No. 2546

Conventional or Low Sulfur Combustor Feedstock	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis			Available Calorific Value, Percent	Total Usable Product, Percent
		Ash	Total Sulfur	Calorific Value Btu/lb		
Zone A (assumed 1.60 Fl.)	38.6	5.99	0.92	14,478		
Zone B (assumed 1.60 Fl.)	33.3	6.53	1.06	14,366		
Zone C, 1.60 Fl.	7.4	13.1	2.30	13,222		
Composite of Fractions	79.3	6.88	1.11	14,314	93.5	90.0
Refuse						
Zone C, 1.60 x 1.90	4.1	41.2	4.56	8,395		
Zone C, 1.90 Sk.	2.2	66.3	5.04	4,146		
Zone D, 1.90 Fl.	1.0	36.9	4.98	9,132		
Zone D, 2.95 Sk.	0.4	60.0	38.9	4,137		
Zone E, 2.95 Sk.	1.1	62.1	41.7	3,742		
Zone D, 1.90 x 2.95	10.4	81.8	3.64	1,781		
Zone E, 2.95 Fl.	1.5	82.6	5.54	1,648		
Composite of Fractions	20.7	68.5	6.86	3,838	6.5	10.0
Composite of Table Fractions	100.0	19.6	2.30	12,146		

TABLE C-3. POTENTIAL COMBUSTION USE OF SELECTED FRACTIONS FROM PHASE II COALS USING "UNCONVENTIONAL" THREE-SPLIT SEPARATION

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

BCR Lot No. 2546

Conventional or Low Sulfur Combustor Feedstock	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis: Ash	Total Sulfur	Calorific Value Btu/lb	Available Calorific Value, Percent	Total Usable Product, Percent
Zone A (assumed 1.60 Fl.)	38.6	5.99	0.92	14,478		
Zone B (assumed 1.60 Fl.)	33.3	6.53	1.06	14,366		
Composite of Fractions	71.9	6.24	0.98	14,426	85.4	81.6
High Sulfur Combustor Feedstock						
Zone C, 1.60 Fl.	7.4	13.1	2.30	13,222		
Zone C, 1.60 x 1.90	4.1	41.2	4.56	8,395		
Zone C, 1.90 Sk.	2.2	66.3	5.04	4,146		
Zone D, 1.90 Fl.	1.0	36.9	4.98	9,132		
Zone D, 2.95 Sk.	0.4	60.0	38.9	4,137		
Zone E, 2.95 Sk.	1.1	62.1	41.7	3,742		
Composite of Fractions	16.2	33.4	6.97	9,650	12.9	18.4
Refuse						
Zone D, 1.90 x 2.95	10.4	81.8	3.64	1,781		
Zone E, 2.95 Fl.	1.5	82.6	5.54	1,648		
Composite of Fractions	11.9	81.9	3.88	1,764	1.7	
Composite of Table Fractions	100.0	19.6	2.30	12,146		

TABLE C-4. POTENTIAL COMBUSTION USE OF SELECTED FRACTIONS FROM PHASE II COALS USING CONVENTIONAL THREE-SPLIT SEPARATION

Coal Identification Pittsburgh Seam, Monongalia County, West Virginia

BCR Lot No. 2555

Conventional or Low Sulfur Combustor Feedstock	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis			Available Calorific Value, Percent	Total Usable Product, Percent
		Ash	Total Sulfur	Calorific Value Btu/lb		
Zone A (assumed 1.60 Fl.)	51.8	6.04	1.84	14,274		
Zone B (assumed 1.60 Fl.)	38.8	6.52	2.06	14,158		
Zone C, 1.60 Fl.	2.2	18.4	3.54	12,242		
Composite of Fractions	92.8	6.54	1.97	14,177	97.8	96.5
High Sulfur Combustor Feedstock						
Zone C, 1.60 x 1.90	1.4	38.6	3.94	8,702		
Zone C, 1.90 Sk.	0.6	57.0	7.74	4,126		
Zone D, 1.90 Fl.	0.6	36.0	3.50	9,224		
Zone D, 2.95 Sk.	0.3	70.4	34.3	2,094		
Zone E, 2.95 Sk.	0.5	69.7	36.8	2,114		
Composite of Fractions	3.4	48.8	12.0	6,437	1.6	3.5
Refuse						
Zone D, 1.90 x 2.95	2.8	73.2	5.34	2,384		
Zone E, 2.95 Fl.	1.0	78.6	4.76	961		
Composite of Fractions	3.8	74.6	5.19	2,010	0.6	
Composite of Table Fractions	100.0	10.6	2.43	13,451		

TABLE C-5. POTENTIAL COMBUSTION USE OF SELECTED FRACTIONS FROM PHASE II COALS USING CONVENTIONAL TWO-SPLIT SEPARATION

Coal Identification Pittsburgh Seam, Monongalia County, West Virginia

BCR Lot No. 2555

Conventional or Low Sulfur Combustor Feedstock	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis: Ash	Chemical Analysis, Weight Percent, Dry Basis: Total Sulfur	Chemical Analysis, Weight Percent, Dry Basis: Calorific Value Btu/lb	Available Calorific Value, Percent	Total Usable Product, Percent
Zone A (assumed 1.60 Fl.)	51.8	6.04	1.84	14,274		
Zone B (assumed 1.60 Fl.)	38.8	6.52	2.06	14,158		
Zone C, 1.60 Fl.	2.2	18.4	3.54	12,242		
Composite of Fractions	92.8	6.54	1.97	14,177	97.8	96.5
Refuse						
Zone C, 1.60 x 1.90	1.4	38.6	3.94	8,702		
Zone C, 1.90 Sk.	0.6	57.0	7.74	4,126		
Zone D, 1.90 Fl.	0.6	36.0	3.50	9,224		
Zone D, 2.95 Sk.	0.3	70.4	34.3	2,094		
Zone E, 2.95 Sk.	0.5	69.7	36.8	2,114		
Zone D, 1.90 x 2.95	2.8	73.2	5.34	2,384		
Zone E, 2.95 Fl.	1.0	78.6	4.76	961		
Composite of Fractions	7.2	62.4	8.42	4,100	2.2	3.5
Composite of Table Fractions	100.0	10.6	2.43	13,451		

TABLE C-6. POTENTIAL COMBUSTION USE OF SELECTED FRACTIONS FROM PHASE II COALS USING CONVENTIONAL THREE-SPLIT SEPARATION

Coal Identification Ohio No. 9 Seam, Harrison County, Ohio

BCR Lot No. 2556

Conventional or Low Sulfur Combustor Feedstock	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis: Ash	Total Sulfur	Calorific Value Btu/lb	Available Calorific Value, Percent	Total Usable Product, Percent
Zone A (assumed 1.60 Fl.)	33.1	11.2	2.18	12,898		
Zone B (assumed 1.60 Fl.)	25.1	11.1	2.09	12,966		
Zone C, 1.60 Fl.	29.1	11.7	2.30	12,801		
Composite of Fractions	87.3	11.3	2.19	12,885	91.8	90.6
High Sulfur Combustor Feedstock						
Zone C, 1.60 x 1.90	2.7	43.2	3.77	7,648		
Zone C, 1.90 Sk.	1.2	61.8	6.31	4,563		
Zone D, 1.90 Fl.	4.0	18.4	2.63	11,740		
Zone D, 2.95 Sk.	0.4	60.4	43.4	2,964		
Zone E, 2.95 Sk.	0.8	60.8	44.6	2,964		
Composite of Fractions	9.1	37.1	8.94	8,419	6.3	9.4
Refuse						
Zone D, 1.90 x 2.95	1.4	65.3	7.30	4,011		
Zone E, 2.95 Fl.	2.2	38.9	5.41	8,360		
Composite of Fractions	3.6	49.2	6.15	6,668	1.9	
Composite of Table Fractions	100.0	15.0	2.95	12,255		

TABLE C-7. POTENTIAL COMBUSTION USE OF SELECTED FRACTIONS FROM PHASE II COALS USING CONVENTIONAL TWO-SPLIT SEPARATION

Coal Identification Ohio No. 9 Seam, Harrison County, Ohio

BCR Lot No. 2556

Conventional or Low Sulfur Combustor Feedstock	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis: Ash	Chemical Analysis, Weight Percent, Dry Basis: Total Sulfur	Chemical Analysis, Weight Percent, Dry Basis: Calorific Value Btu/lb	Available Calorific Value, Percent	Total Usable Product, Percent
Zone A (assumed 1.60 Fl.)	33.1	11.2	2.18	12,898		
Zone B (assumed 1.60 Fl.)	25.1	11.1	2.09	12,966		
Zone C, 1.60 Fl.	29.1	11.7	2.30	12,801		
Composite of Fractions	87.3	11.3	2.19	12,885	91.8	87.3
Refuse						
Zone C, 1.60 x 1.90	2.7	43.2	3.77	7,648		
Zone C, 1.90 Sk.	1.2	61.8	6.31	4,563		
Zone D, 1.90 Fl.	4.0	18.4	2.63	11,740		
Zone D, 2.95 Sk.	0.4	60.4	43.4	2,964		
Zone E, 2.95 Sk.	0.8	60.8	44.6	2,964		
Zone D, 1.90 x 2.95	1.4	65.3	7.30	4,011		
Zone E, 2.95 Fl.	2.2	38.9	5.41	8,360		
Composite of Fractions	12.7	40.5	8.16	7,922	8.2	12.7
Composite of Table Fractions	100.0	15.0	2.95	12,255		

TABLE C-8. POTENTIAL COMBUSTION USE OF SELECTED FRACTIONS FROM PHASE II COALS USING CONVENTIONAL THREE-SPLIT SEPARATION

Coal Identification Ohio No. 8 Seam, Jefferson County, Ohio

BCR Lot No. 2574

Conventional or Low Sulfur Combustor Feedstock	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis: Ash	Total Sulfur	Calorific Value Btu/lb	Available Calorific Value, Percent	Total Usable Product, Percent
Zone A (assumed 1.60 Fl.)	40.9	6.90	2.66	13,686		
Zone B (assumed 1.60 Fl.)	41.2	6.50	2.74	13,756		
Zone C, 1.60 Fl.	8.8	8.52	3.54	13,396		
Composite of Fractions	90.9	6.88	2.78	13,689	97.1	95.0
High Sulfur Combustor Feedstock						
Zone C, 1.60 x 1.90	1.6	34.3	8.80	8,943		
Zone C, 1.90 Sk.	0.6	57.9	14.1	4,875		
Zone D, 1.90 Fl.	0.5	33.2	8.58	9,172		
Zone D, 2.95 Sk.	0.4	59.4	44.0	2,784		
Zone E, 2.95 Sk.	1.7	60.6	44.4	2,868		
Composite of Fractions	4.8	48.6	25.0	5,790	2.2	5.0
Refuse						
Zone D, 1.90 x 2.95	2.8	73.7	7.33	2,646		
Zone E, 2.95 Fl.	1.5	80.4	6.58	1,560		
Composite of Fractions	4.3	76.0	7.07	2,267	0.7	
Composite of Table Fractions	100.0	11.8	4.03	12,819		

TABLE C-9. POTENTIAL COMBUSTION USE OF SELECTED FRACTIONS FROM PHASE II COALS USING CONVENTIONAL TWO-SPLIT SEPARATION

Coal Identification Ohio No. 8 Seam, Jefferson County, Ohio

BCR Lot No. 2574

Conventional or Low Sulfur Combustor Feedstock	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis			Available Calorific Value, Percent	Total Usable Product, Percent
		Ash	Total Sulfur	Calorific Value Btu/lb		
Zone A (assumed 1.60 Fl.)	40.9	6.90	2.66	13,686		
Zone B (assumed 1.60 Fl.)	41.2	6.50	2.74	13,756		
Zone C, 1.60 Fl.	8.8	8.52	3.54	13,396		
Composite of Fractions	90.9	6.88	2.78	13,689	97.1	95.0
Refuse						
Zone C, 1.60 x 1.90	1.6	34.3	8.80	8,943		
Zone C, 1.90 Sk.	0.6	57.9	14.1	4,875		
Zone D, 1.90 Fl.	0.5	33.2	8.58	9,172		
Zone D, 2.95 Sk.	0.4	59.4	44.0	2,784		
Zone E, 2.95 Sk.	1.7	60.6	44.4	2,868		
Zone D, 1.90 x 2.95	2.8	73.7	7.33	2,646		
Zone E, 2.95 Fl.	1.5	80.4	6.58	1,560		
Composite of Fractions	9.1	61.5	16.5	4,129	2.9	5.0
Composite of Table Fractions	100.0	11.8	4.03	12,819		

TABLE C-10. POTENTIAL COMBUSTION USE OF SELECTED FRACTIONS FROM PHASE II COALS USING CONVENTIONAL THREE-SPLIT SEPARATION

Coal Identification Franklin L. B. Seam, Garrett County, Maryland

BCR Lot No. 2579

Conventional or Low Sulfur Combustor Feedstock	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis			Available Calorific Value, Percent	Total Usable Product, Percent
		Ash	Total Sulfur	Calorific Value Btu/lb		
Zone A (assumed 1.60 Fl.)	46.3	15.6	3.12	13,018		
Zone B (assumed 1.60 Fl.)	33.5	16.8	3.44	12,825		
Zone C, 1.60 Fl.	2.0	18.2	3.88	12,586		
Composite of Fractions	81.8	16.2	3.27	12,929	92.3	88.3
High Sulfur Combustor Feedstock						
Zone C, 1.60 x 1.90	2.3	40.4	6.34	8,578		
Zone C, 1.90 Sk.	5.0	63.0	6.16	4,757		
Zone D, 1.90 Fl.	2.2	37.4	6.86	9,122		
Zone D, 2.95 Sk.	0.5	59.9	39.5	3,592		
Zone E, 2.95 Sk.	0.8	60.6	39.0	3,588		
Composite of Fractions	10.8	52.6	10.3	6,321	6.0	11.7
Refuse						
Zone D, 1.90 x 2.95	5.1	74.9	6.47	2,848		
Zone E, 2.95 Fl.	2.3	76.4	9.38	2,434		
Composite of Fractions	7.4	75.4	7.38	2,719	1.7	
Composite of Table Fractions	100.0	24.5	4.34	11,457		

TABLE C-11. POTENTIAL COMBUSTION USE OF SELECTED FRACTIONS FROM PHASE II COALS USING CONVENTIONAL TWO-SPLIT SEPARATION

Coal Identification Franklin L. B. Seam, Garrett County, Maryland

BCR Lot No. 2579

Conventional or Low Sulfur Combustor Feedstock	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis			Available Calorific Value, Percent	Total Usable Product, Percent
		Ash	Total Sulfur	Calorific Value Btu/lb		
Zone A (assumed 1.60 Fl.)	46.3	15.6	3.12	13,018		
Zone B (assumed 1.60 Fl.)	33.5	16.8	3.44	12,825		
Zone C, 1.60 Fl.	2.0	18.2	3.88	12,586		
Composite of Fractions	81.8	16.2	3.27	12,929	92.3	88.3
Refuse						
Zone C, 1.60 x 1.90	2.3	40.4	6.34	8,578		
Zone C, 1.90 Sk.	5.0	63.0	6.16	4,757		
Zone D, 1.90 Fl.	2.2	37.4	6.86	9,122		
Zone D, 2.95 Sk.	0.5	59.9	39.5	3,592		
Zone E, 2.95 Sk.	0.8	60.6	39.0	3,588		
Zone D, 1.90 x 2.95	5.1	74.9	6.47	2,848		
Zone E, 2.95 Fl.	2.3	76.4	9.38	2,434		
Composite of Fractions	18.2	61.9	9.11	4,855	7.7	11.7
Composite of Table Fractions	100.0	24.5	4.34	11,457		

TABLE C-12. POTENTIAL COMBUSTION USE OF SELECTED FRACTIONS FROM PHASE II COALS
USING CONVENTIONAL THREE-SPLIT SEPARATION

Coal Identification Upper Freeport Seam, Preston County, West Virginia

BCR Lot No. 2630

Conventional or Low Sulfur Combustor Feedstock	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis			Available Calorific Value, Percent	Total Usable Product, Percent
		Ash	Total Sulfur	Calorific Value Btu/lb		
Zone A (assumed 1.60 Fl.)	54.4	7.69	1.09	14,275		
Zone B (assumed 1.60 Fl.)	23.3	9.20	1.20	14,036		
Zone C, 1.60 Fl.	1.6	19.8	2.24	12,159		
Composite of Fractions	79.3	8.38	1.15	14,162	93.5	90.9
High Sulfur Combustor Feedstock						
Zone C, 1.60 x 1.90	3.4	43.2	3.24	8,208		
Zone C, 1.90 Sk.	1.2	58.8	7.00	5,318		
Zone D, 1.90 Fl.	0.8	44.0	3.26	8,068		
Zone D, 2.95 Sk.	0.1	59.1	37.6	4,212		
Zone E, 2.95 Sk.	2.4	60.2	42.2	3,690		
Composite of Fractions	7.9	51.0	16.1	6,329	4.2	9.1
Refuse						
Zone D, 1.90 x 2.95	8.3	78.6	4.00	2,070		
Zone E, 2.95 Fl.	4.5	77.4	6.92	2,332		
Composite of Fractions	12.8	78.2	5.03	2,162	2.3	
Composite of Table Fractions	100.0	20.7	2.82	12,003		

TABLE C-13. POTENTIAL COMBUSTION USE OF SELECTED FRACTIONS FROM PHASE II COALS USING CONVENTIONAL TWO-SPLIT SEPARATION

Coal Identification Upper Freeport Seam, Preston County, West Virginia

BCR Lot No. 2630

Conventional or Low Sulfur Combustor Feedstock	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis			Available Calorific Value, Percent	Total Usable Product, Percent
		Ash	Total Sulfur	Calorific Value Btu/lb		
Zone A (assumed 1.60 Fl.)	54.4	7.69	1.09	14,275		
Zone B (assumed 1.60 Fl.)	23.3	9.20	1.20	14,036		
Zone C, 1.60 Fl.	1.6	19.8	2.24	12,159		
Composite of Fractions	79.3	8.38	1.15	14,162	93.5	90.9
Refuse						
Zone C, 1.60 x 1.90	3.4	43.2	3.24	8,208		
Zone C, 1.90 Sk.	1.2	58.8	7.00	5,318		
Zone D, 1.90 Fl.	0.8	44.0	3.26	8,068		
Zone D, 2.95 Sk.	0.1	59.1	37.6	4,212		
Zone E, 2.95 Sk.	2.4	60.2	42.2	3,690		
Zone D, 1.90 x 2.95	8.3	78.6	4.00	2,070		
Zone E, 2.95 Fl.	4.5	77.4	6.92	2,332		
Composite of Fractions	20.7	67.8	9.25	3,754	6.5	9.1
Composite of Table Fractions	100.0	20.7	2.82	12,003		

TABLE C-14. POTENTIAL COMBUSTION USE OF SELECTED FRACTIONS FROM PHASE II COALS USING CONVENTIONAL THREE-SPLIT SEPARATION

Coal Identification Illinois No. 6 Seam, Franklin County, Illinois

BCR Lot No. 2651

Conventional or Low Sulfur Combustor Feedstock	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis: Ash	Total Sulfur	Calorific Value Btu/lb	Available Calorific Value, Percent	Total Usable Product, Percent
Zone A (assumed 1.60 Fl.)	29.9	8.03	2.30	13,206		
Zone B (assumed 1.60 Fl.)	28.4	7.96	2.24	13,242		
Zone C, 1.60 Fl.	32.0	8.94	2.42	13,098		
Composite of Fractions	90.3	8.33	2.32	13,179	96.5	94.9
High Sulfur Combustor Feedstock						
Zone C, 1.60 x 1.90	1.9	37.5	5.00	8,461		
Zone C, 1.90 Sk.	0.8	59.5	12.0	4,262		
Zone D, 1.90 Fl.	0.8	36.6	6.98	8,564		
Zone D, 2.95 Sk.	0.5	63.2	39.6	3,122		
Zone E, 2.95 Sk.	0.9	63.6	41.9	2,948		
Composite of Fractions	4.9	48.4	16.8	6,234	2.5	5.1
Refuse						
Zone D, 1.90 x 2.95	3.1	69.0	10.3	3,115		
Zone E, 2.95 Fl.	1.7	71.6	9.22	1,982		
Composite of Fractions	4.8	69.9	9.92	2,714	1.0	
Composite of Table Fractions	100.0	13.2	3.40	12,337		

TABLE C-15. POTENTIAL COMBUSTION USE OF SELECTED FRACTIONS FROM PHASE II COALS USING CONVENTIONAL TWO-SPLIT SEPARATION

Coal Identification Illinois No. 6 Seam, Franklin County, Illinois

BCR Lot No. 2651

Conventional or Low Sulfur Combustor Feedstock	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis: Ash	Total Sulfur	Calorific Value Btu/lb	Available Calorific Value, Percent	Total Usable Product, Percent
Zone A (assumed 1.60 Fl.)	29.9	8.03	2.30	13,206		
Zone B (assumed 1.60 Fl.)	28.4	7.96	2.24	13,242		
Zone C, 1.60 Fl.	32.0	8.94	2.42	13,098		
Composite of Fractions	90.3	8.33	2.32	13,179	96.5	94.9
Refuse						
Zone C, 1.60 x 1.90	1.9	37.5	5.00	8,461		
Zone C, 1.90 Sk.	0.8	59.5	12.0	4,262		
Zone D, 1.90 Fl.	0.8	36.6	6.98	8,564		
Zone D, 2.95 Sk.	0.5	63.2	39.6	3,122		
Zone E, 2.95 Sk.	0.9	63.6	41.9	2,948		
Zone D, 1.90 x 2.95	3.1	69.0	10.3	3,115		
Zone E, 2.95 Fl.	1.7	71.6	9.22	1,982		
Composite of Fractions	9.7	59.0	13.4	4,490	3.5	5.1
Composite of Table Fractions	100.0	13.2	3.40	12,337		

TABLE C-16. POTENTIAL COMBUSTION USE OF SELECTED FRACTIONS FROM PHASE II COALS USING CONVENTIONAL THREE-SPLIT SEPARATION

Coal Identification Ohio No. 5 Seam, Muskingum County, Ohio

BCR Lot No. 2694

Conventional or Low Sulfur Combustor Feedstock	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis			Available Calorific Value, Percent	Total Usable Product, Percent
		Ash	Total Sulfur	Calorific Value Btu/lb		
Zone A (assumed 1.60 Fl.)	37.2	8.64	3.33	13,114		
Zone B (assumed 1.60 Fl.)	39.7	7.55	3.32	13,264		
Zone C, 1.60 Fl.	11.3	10.3	4.76	12,634		
Composite of Fractions	88.2	8.21	3.51	12,931	94.8	90.3
High Sulfur Combustor Feedstock						
Zone C, 1.60 x 1.90	2.0	25.0	12.6	9,844		
Zone C, 1.90 Sk.	2.9	48.9	26.2	5,579		
Zone D, 1.90 Fl.	0.2	22.5	13.8	10,526		
Zone D, 2.95 Sk.	2.1	60.4	43.5	3,154		
Zone E, 2.95 Sk.	2.3	63.6	45.4	2,802		
Composite of Fractions	9.5	49.4	31.5	5,375	4.3	9.7
Refuse						
Zone D, 1.90 x 2.95	2.0	54.6	22.9	5,148		
Zone E, 2.95 Fl.	0.3	70.0	18.8	3,370		
Composite of Fractions	2.3	56.6	22.4	4,917	0.9	
Composite of Table Fractions	100.0	13.2	6.60	12,029		

TABLE C-17. POTENTIAL COMBUSTION USE OF SELECTED FRACTIONS FROM PHASE II COALS USING CONVENTIONAL TWO-SPLIT SEPARATION

Coal Identification Ohio No. 5 Seam, Muskingum County, Ohio

BCR Lot No. 2694

Conventional or Low Sulfur Combustor Feedstock	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis			Available Calorific Value, Percent	Total Usable Product, Percent
		Ash	Total Sulfur	Calorific Value Btu/lb		
Zone A (assumed 1.60 Fl.)	37.2	8.64	3.33	13,114		
Zone B (assumed 1.60 Fl.)	39.7	7.55	3.32	13,264		
Zone C, 1.60 Fl.	11.3	10.3	4.76	12,634		
Composite of Fractions	88.2	8.21	3.51	12,931	94.8	90.3
Refuse						
Zone C, 1.60 x 1.90	2.0	25.0	12.6	9,844		
Zone C, 1.90 Sk.	2.9	48.9	26.2	5,579		
Zone D, 1.90 Fl.	0.2	22.5	13.8	10,526		
Zone D, 2.95 Sk.	2.1	60.4	43.5	3.154		
Zone E, 2.95 Sk.	2.3	63.6	45.4	2,802		
Zone D, 1.90 x 2.95	2.0	54.6	22.9	5,148		
Zone E, 2.95 Fl.	0.3	70.0	18.8	3,370		
Composite of Fractions	11.8	50.8	29.8	5,280	5.2	9.7
Composite of Table Fractions	100.0	13.2	6.60	12,029		

TABLE C-18. POTENTIAL COMBUSTION USE OF SELECTED FRACTIONS FROM PHASE II COALS USING CONVENTIONAL THREE-SPLIT SEPARATION

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

BCR Lot No. 2713

Conventional or Low Sulfur Combustor Feedstock	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis			Available Calorific Value, Percent	Total Usable Product, Percent
		Ash	Total Sulfur	Calorific Value Btu/lb		
Zone A (assumed 1.60 Fl.)	53.5	9.44	1.06	13,881		
Zone B (assumed 1.60 Fl.)	21.7	12.5	1.09	13,332		
Zone C, 1.60 Fl.	2.6	20.0	1.49	12,050		
Composite of Fractions	77.8	10.6	1.08	13,667	92.7	88.4
High Sulfur Combustor Feedstock						
Zone C, 1.60 x 1.90	4.1	45.8	1.76	7,664		
Zone C, 1.90 Sk.	3.8	66.8	2.27	4,077		
Zone D, 1.90 Fl.	1.1	44.5	1.92	7,892		
Zone D, 2.95 Sk.	0.2	60.1	39.6	3,920		
Zone E, 2.95 Sk.	1.0	60.6	42.1	3,624		
Composite of Fractions	10.2	55.2	6.68	5,883	5.2	11.6
Refuse						
Zone D, 1.90 x 2.95	9.4	78.1	2.39	2,106		
Zone E, 2.95 Fl.	2.6	81.0	4.11	1,600		
Composite of Fractions	12.0	78.7	2.76	2,003	2.1	
Composite of Table Fractions	100.0	23.3	1.85	11,473	100.0	100.0

TABLE C-19. POTENTIAL COMBUSTION USE OF SELECTED FRACTIONS FROM PHASE II COALS USING CONVENTIONAL TWO-SPLIT SEPARATION

Coal Identification Upper Freeport Seam, Armstrong County, Pennsylvania

BCR Lot No. 2713

Conventional or Low Sulfur Combustor Feedstock	Product, Weight Percent	Chemical Analysis, Weight Percent, Dry Basis: Ash	Total Sulfur	Calorific Value Btu/lb	Available Calorific Value, Percent	Total Usable Product, Percent
Zone A (assumed 1.60 Fl.)	53.5	9.44	1.06	13,881		
Zone B (assumed 1.60 Fl.)	21.7	12.5	1.09	13,332		
Zone C, 1.60 Fl.	2.6	20.0	1.49	12,050		
Composite of Fractions	77.8	10.6	1.08	13,667	92.7	88.4
Refuse						
Zone C, 1.60 x 1.90	4.1	45.8	1.76	7,664		
Zone C, 1.90 Sk.	3.8	66.8	2.27	4,077		
Zone D, 1.90 Fl.	1.1	44.5	1.92	7,892		
Zone D, 2.95 Sk.	0.2	60.1	39.6	3,920		
Zone E, 2.95 Sk.	1.0	60.6	42.1	3,624		
Zone D, 1.90 x 2.95	9.4	78.1	2.39	2,106		
Zone E, 2.95 Fl.	2.6	81.0	4.11	1,600		
Composite of Fractions	22.2	67.9	4.54	3,786	7.3	11.6
Composite of Table Fractions	100.0	23.3	1.85	11,473	100.0	100.0